

**The Use of a
Mathematical Instrument,
called a**

QUADRANT:

Shewing very plainly and easily

to know the exact Height or Distance of any Steeple, Tree, or House, &c. Also to know the Hour of the Day by it: the Height of the *Sun*, *Moon*, or *Stars*: and to know the time of Sun-rising, and setting; and the length of every Day in the Year: the place of the Sun in the Eclipse: the Azimuth, Right Ascension, and Declination of the Sun. With many other necessary and delightfull Conclusions. Performed very readily.

As also the Use of a Nocturnal whereby you may learn to know the Stars in Heaven, and the Hour of the Night, by them. With many other delightfull operations.

The second Edition, wherein the mistakes in the former Impression are Corrected. By *W. P.*

Psal. 92. 6. A brutish man knoweth not: neither doth a fool understand This.

The Quadrants, Nocturnals, and these Books, are to be sold by *Joseph Moxon*, at his shop in *Corn-hill* at the Signe of *Atlas*, in *London*, 1659.

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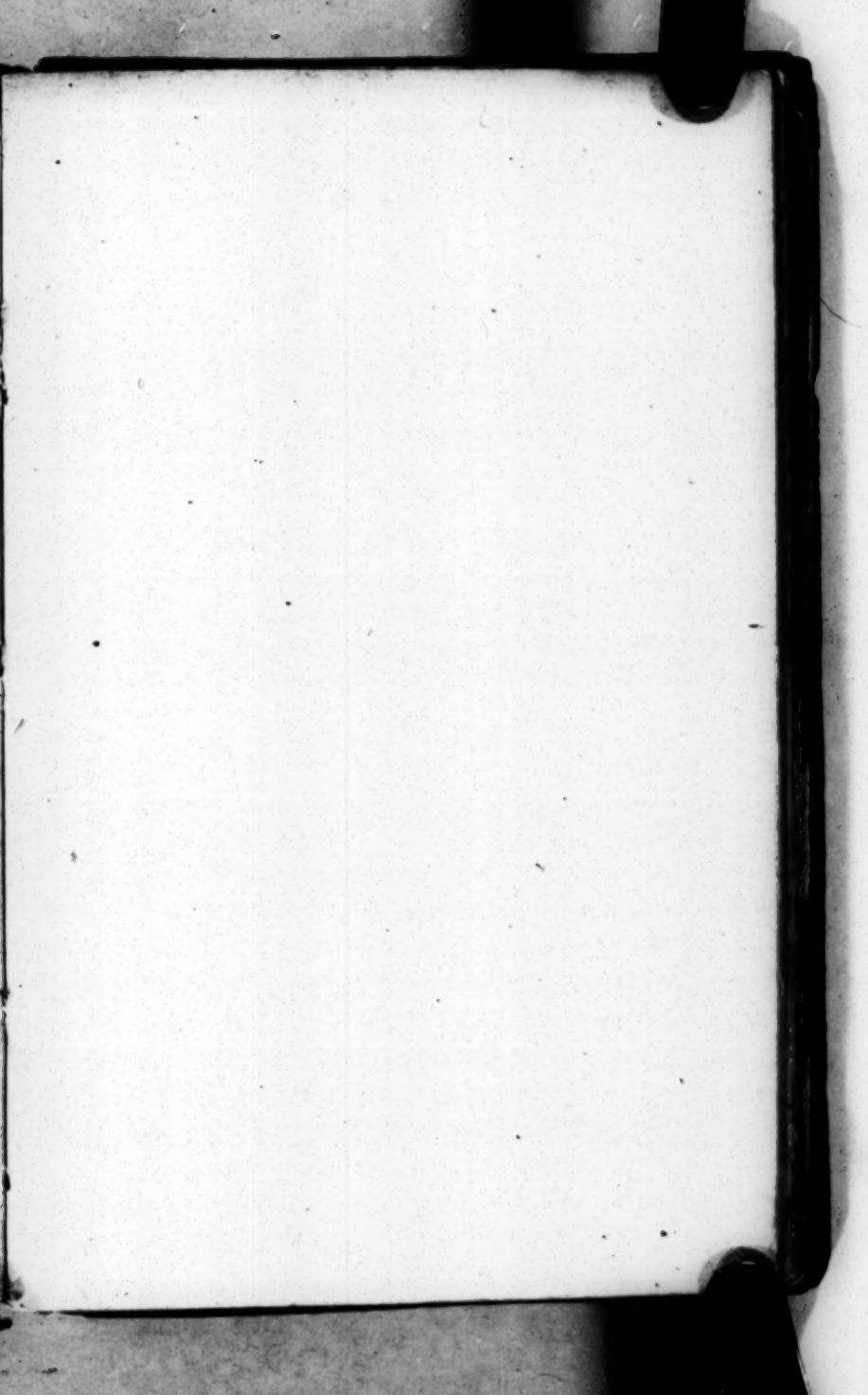
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With certain Engines to produce either Motion or Sound
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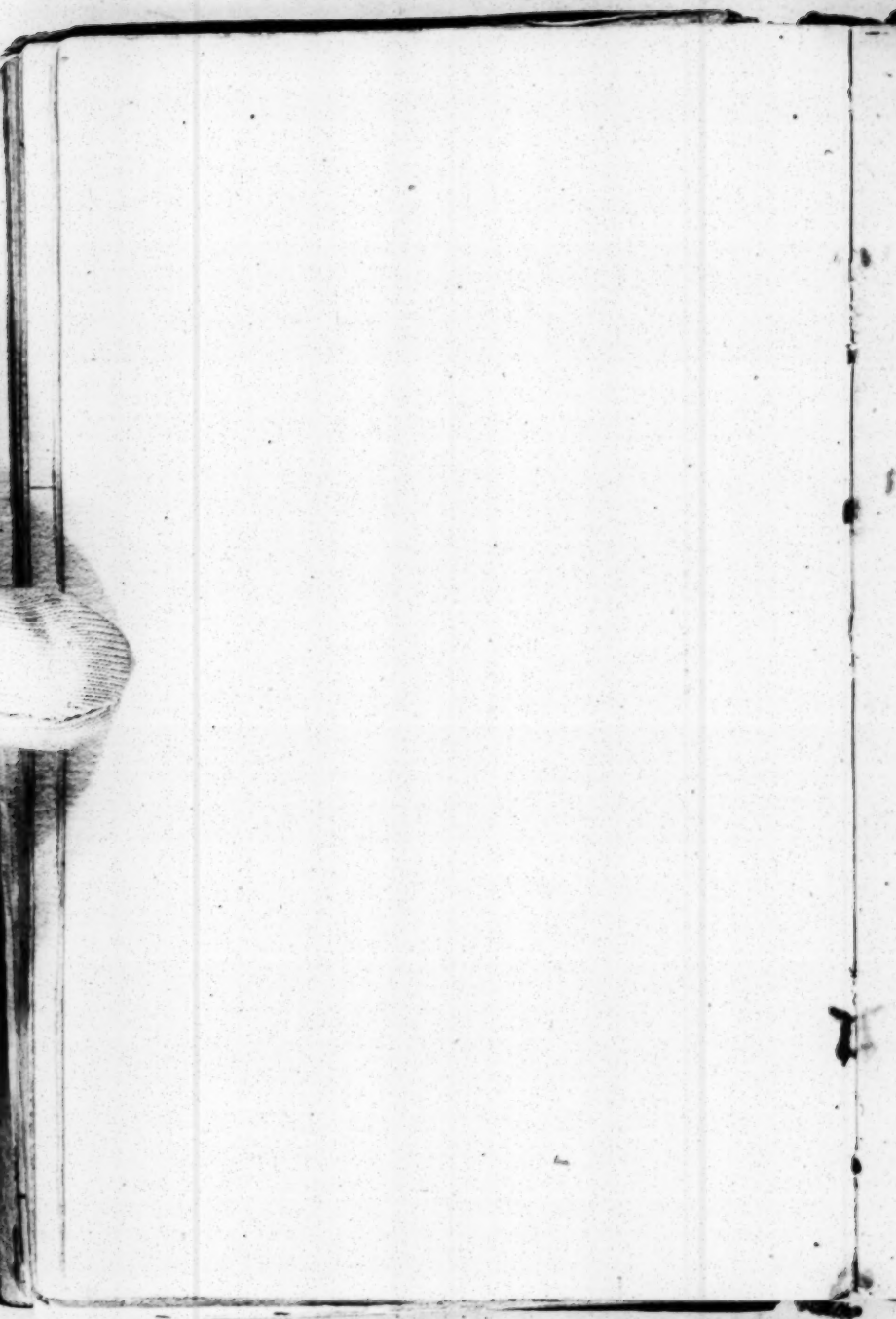
A Help to Calculation By J. Newton A. D. 1687


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and Maps whatsoever, are sold by the foresaid J. Moxon.







To the Reader.

R Eader, What I have here written of the use of the Quadrant, was intended for the use of some of my friends, that understand not the use of that Instrument; which when Mr Moxon saw, he requested the Copy of me, to accommodate such of his Customers withall, as buy his Quadrants, and yet understand not the use of them.

What is written concerning this Quadrant and Quadrat, is written in general for all Quadrants and Quadrats; but what concerns the Hour-lines, is particular to this Instrument; and were first hinted at by Stofler, and afterwards perfected by Mr Gunter; with addition of Azimuth Lines, &c.

Now if you desire to learn the projecting of these Hour and Azimuth Lines, you must peruse M. Gunter, who hath made Tables of purpose for the carrying on of these Lines from the Equator to the Tropick, for this Latitude; and given you directions how you shall make other Tables for all Latitudes: which here is not my

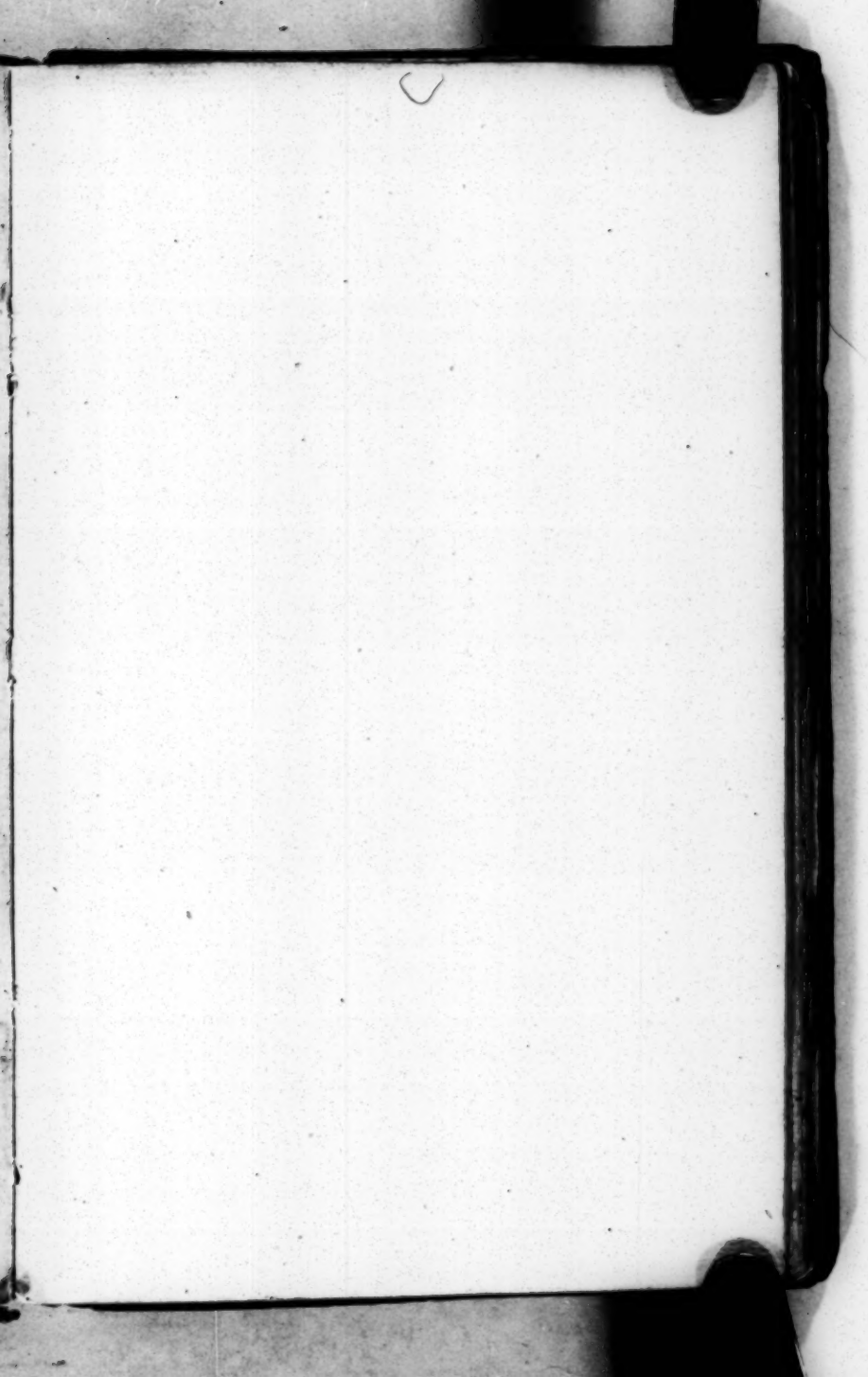
To the Reader.

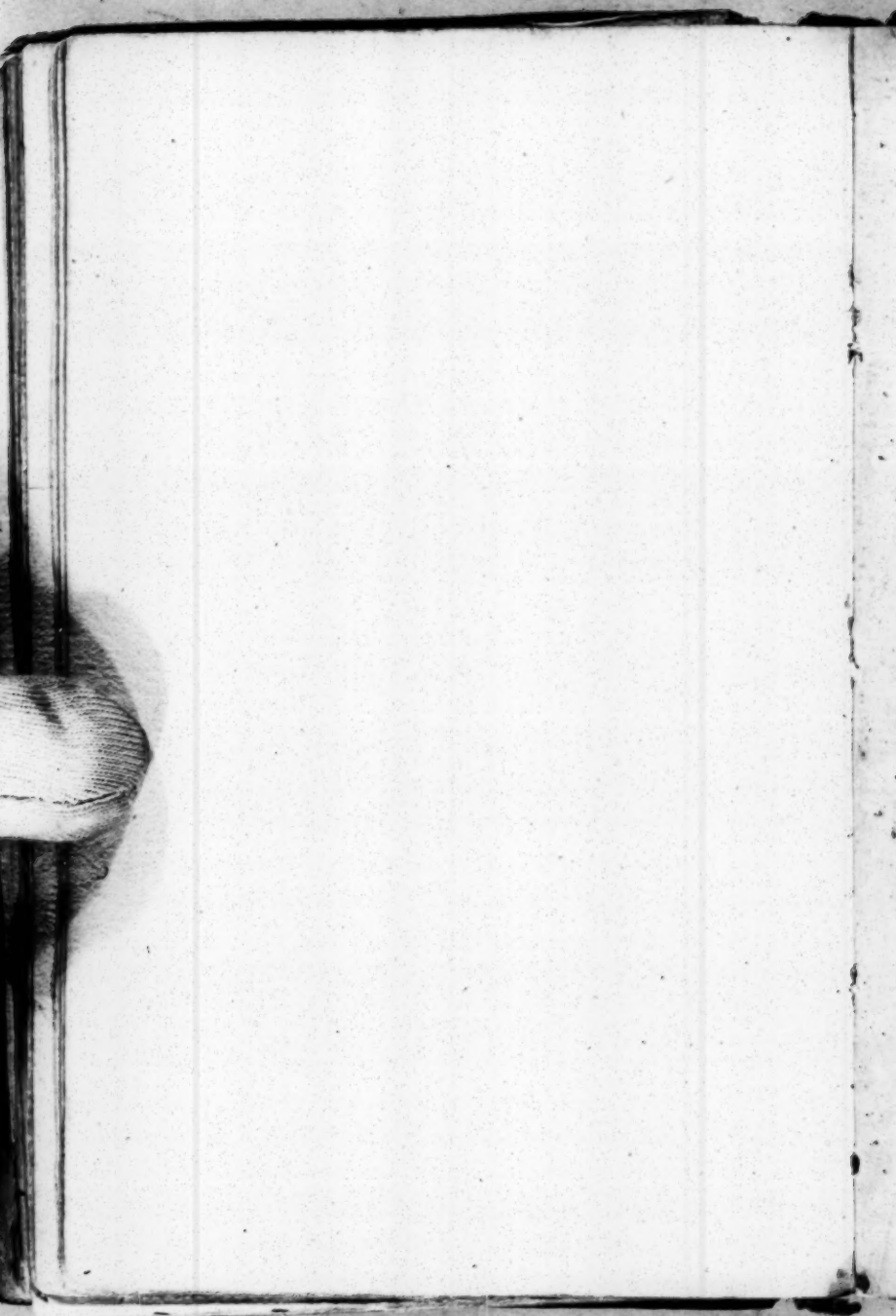
task to insert. Neither would I have you think that what I have written concerning the use of these Hour and Azimuth Lines, proceeds from my own head, but from Mr Gunter's instructions; which I have digested into such a Method as I thought would be most plain for my friends to understand. Therefore to them that are unskilfull in the use of this Instrument, have I directed these few lines, and not to the Learned, who are better able to instruct me in these and other Mathematical Conclusions, than to receive any instruction from.

Their real Well-willer,

W. P.

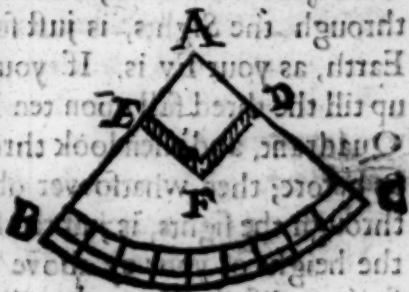
THE





THE USE Of the Quadrant.

A Quadrant is the fourth part of a Circle, and is comprehended between two Semidiameters; as in the Figure A B C, where A is the Center, A B one of the Semidiameters, and A C the other, and the outmost Verge B C is the Limb of the Quadrant: or more properly the Quadrant it self; being one Quarter of a Circle, and therefore is called by the Latine word *Quadrant*.



The use of

The Quadrant *BCE* is divided into 90 equal parts, called Degrees; for, because the whole Circle contains 360. Degrees, therefore the Quadrant (which is the fourth part) must contain 90 Degrees: each of these Degrees are divided into half, or quarter, or more, (as the largeness of the Instrument will admit) being numbred at every tenth Degree, as 10, 20, 30, 40. &c.

Now forasmuch as 90 Degrees is the highest elevation, or lowest depression of any thing, therefore very aptly doth this Instrument serve for *Mensuration*; as for example.

If you hold the limb of the Quadrant toward you, and the uppermost Semidiameter of the Quadrant Parallel with the Earth or Water, then what object soever you behold through the Sights, is just so high above the Earth, as your Ey is. If you lift the Center up till the thred fall upon ten Degrees in your Quadrant, and then look through the Sight, as before; then whatsoever object you behold through the sights, is just ten Degrees high, and the height of your ey above the ground: Also if you lift the Center up till the thred fall on twenty Degrees, then what object you see through the Sights, is twenty Degrees high; and so of all the rest.

By

the Quadrant.

3.

By this you may understand what the Quadrant is made for, and what it represents: and though it may be imployed for many other things, as the taking of Angles at any distance, yet the general use is in what is aforesaid. Now therefore I will speak somewhat of the exact way to use the Quadrant, and to avoid error in the use of it.

Take the Quadrant in your hand, and hold it so that the thred to which the Plummer is fixed, may hang down close by the face or flat of the Quadrant; and be sure that the thred do not lean upon the Limb, or that it do not hang too far from it, but that it even touch it; then in this posture bring the Quadrant to your eye, and look through both the Sights, till you see the Sun, Star, or other object, which you would observe; then holding the Quadrant steady, still looking upon the Sun, Star, or other object, lay your finger upon the thred, and so many Degrees as you find between the thred upon the Limb, and the end of the Limb from the Semidiameter upon which the Sights are placed, so many Degrees is the Sun distant from your Zenith; and so many Degrees as is between the thred and the other end of the Limb, so many Degrees is the height of the Sun or Star you observe above the Horizon.

EXAM-

EXAMPLE.

Looking through the Sights to the Sun, I find the thred to fall upon 45 Degrees of the Quadrant; therefore I say, the Sun is just 45 Degrees above the Horizon; and 45 Degrees from the Zenith,

Again, looking through the Sights upon a certain Star, I find the thred to fall upon 39 Degrees and an half; therefore I say, that that Star is 39 Degrees and an half above the Horizon, and 50 Degrees and an half from the Zenith.

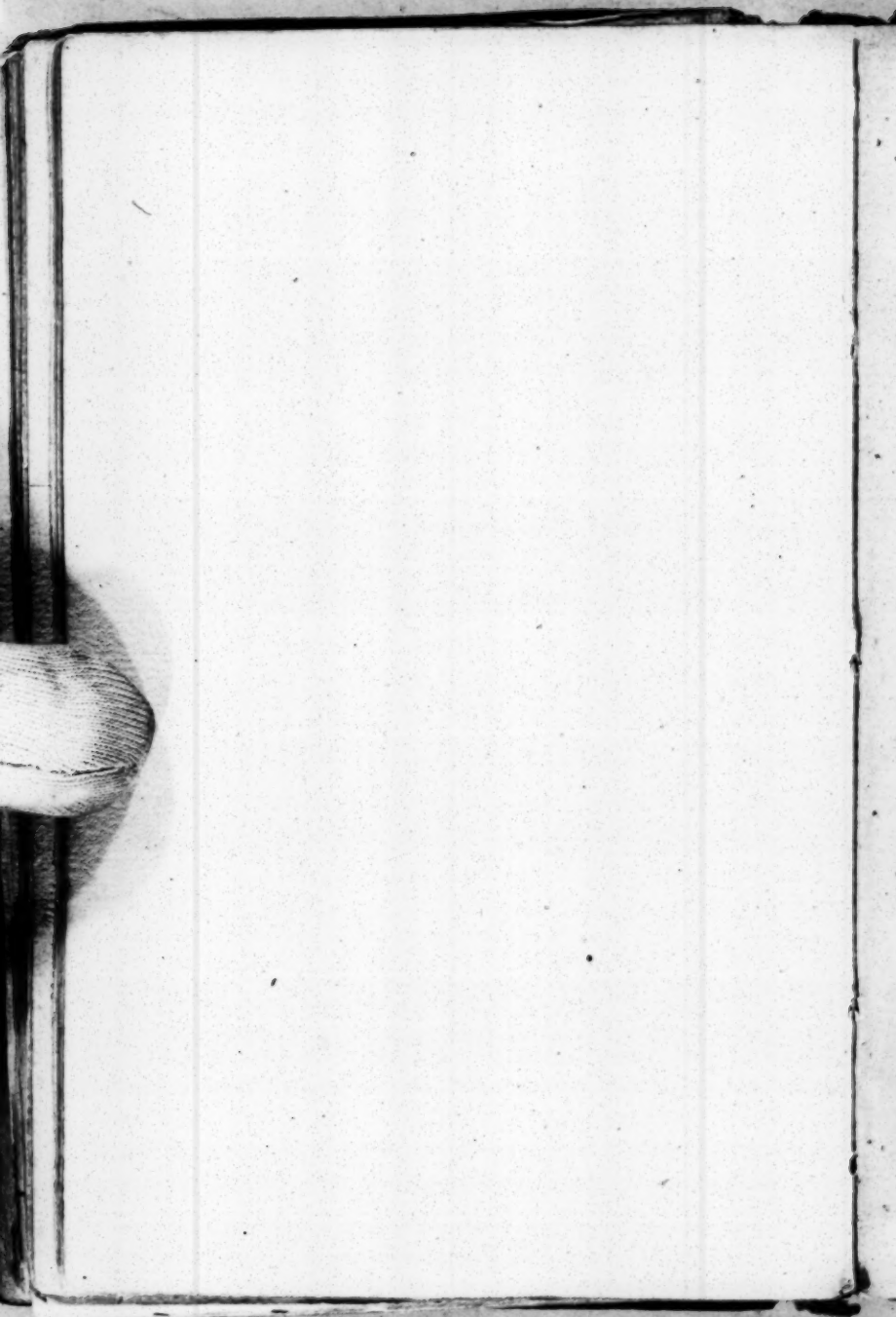
*To take the Altitude of the Sun,
without looking by the ey.*

Let the Sun shine through the first Sight next the Center, and bring that beam of the Sun to fall right upon the hole of the other Sight, and it will be as well or better then if you had observed it with your ey; and then the thred will fall upon the true Altitude of the Sun above the Horizon.

What is meant by Altitude.

THe Altitude of the Sun, Moon, or Stars, is not so many Miles, Poles, Rods, &c. as is between the Ey, and the Sun, Moon, or Star; but it is so many Degrees and Minutes as is between the Sun or Star, and the Horizon; and therefore 'tis said to be so far above the Horizon.





the Quadrant.

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zon. I take M. Norwoods experiment for the best, who saith, That a Degree in the Heaven contains 69 English miles or thereabout; so that this is true, That if I take the Altitude of the Sun at any time, and find 53 Degrees from my Zenith, I say that there is 53 times 69 miles between the place where I am, and the place in whose Zenith the Sun was at that time: and by this means you may know how far it is to any place over which the Sun or Star is at any time.

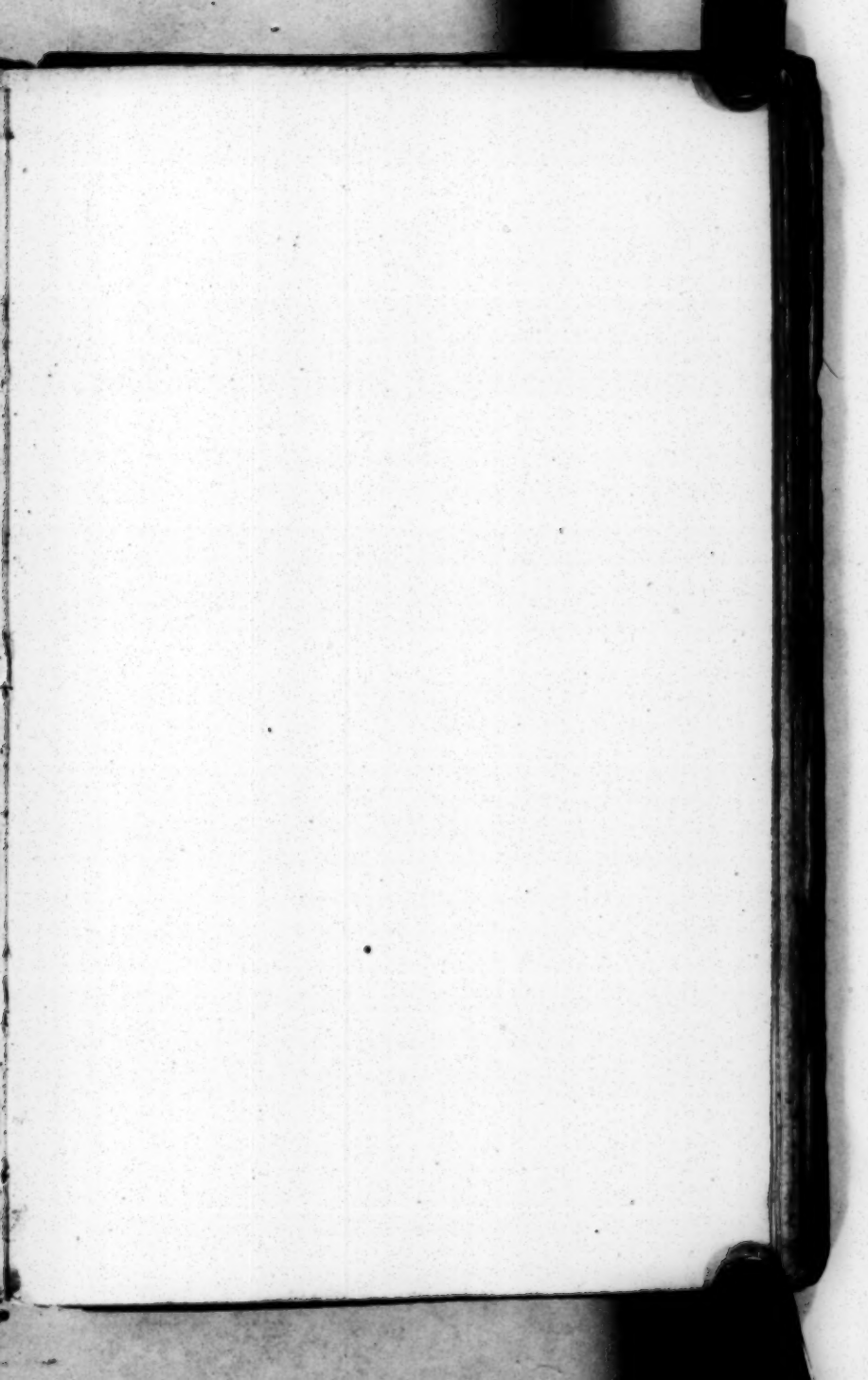
Now in some Quadrants there is described a *Quadrat*, which is made of two lines coming from the Semidiameters. A B and A C, as in the Figure you may see marked; and they are divided into fifty equal parts. That part of the *Quadrat* which is next the Sights, is called *The Scale of Contrary shadow*; and that other, *The Scale of Right shadow*. The use of the *Quadrat*, is to take Heights and Distances without measuring them.

The best and most easie way for the taking Heights and Distances, is by the *Rule of Proportion*; because then any station taken will do the work; But because some are not seen in Arithmetick, I will first shew how to take Heights and distances without the rule of Proportion.

Mark

Mark the place whose height you would know, and look through the Sights to the place, and go backwards or forward untill the third fall just between the line of right and Contrary shadow upon the Quadrant; which is upon 45 deg. of the Quadrant; or else just upon one half of the parts of Right or Contrary shadow; or just upon one quarter of Right or Contrary shadow; then looking through the Sights towards the Center, observe till you find the third fall just between Right and Contrary shadow; then is the height equal to the distance: but if it fall upon one half of the parts of Right shadow; then is the height but half the distance; if it fall upon one quarter of Right shadow, then is the height but a quarter of the distance; if it falls on three quarters of Right shadow; then is the height three quarters of the distance. Now of the parts of Contrary shadow; if the third fall upon half the parts of Contrary shadow, then is the height double to the distance; if half way between this and the Semidiameter wherein the Sights are placed, then is the height





the Quadrant.

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height four times as much as the distance. Now according as the Quadrant is divided, you may find hereby the way to work the question.

I will give you an example of these, by which they may be the better understood.

I take a Quadrant that hath a Quadrant, the parts of whose right shadow are divided into fifty parts, and the contrary shadow into fifty parts, and I would know the height of a Steeple: therefore looking through the Sights to the top of it, I find the thred to fall between Right and Contrary shadow; then I measure from the place where I stood, and find it to be 25 yards and an half between that and the foot of the Steeple, to which adding my length from my ey to the ground, being a yard and an half, it makes 27 yards, the just height of the Steeple: for you must alwaies remember to add the length of your ey from the ground.

Again, looking to the top of the Steeple, the thred falls upon 25 yards of Right shadow; and measuring, I find 51 yards between me and the foot of the Steeple; the half whereof is 25 yards and an half, to which adding one yard and an half for my body, makes 27 yards; the height of the Steeple.

Now taking another Station, I find when I look to the top of the Steeple, that the thred falls

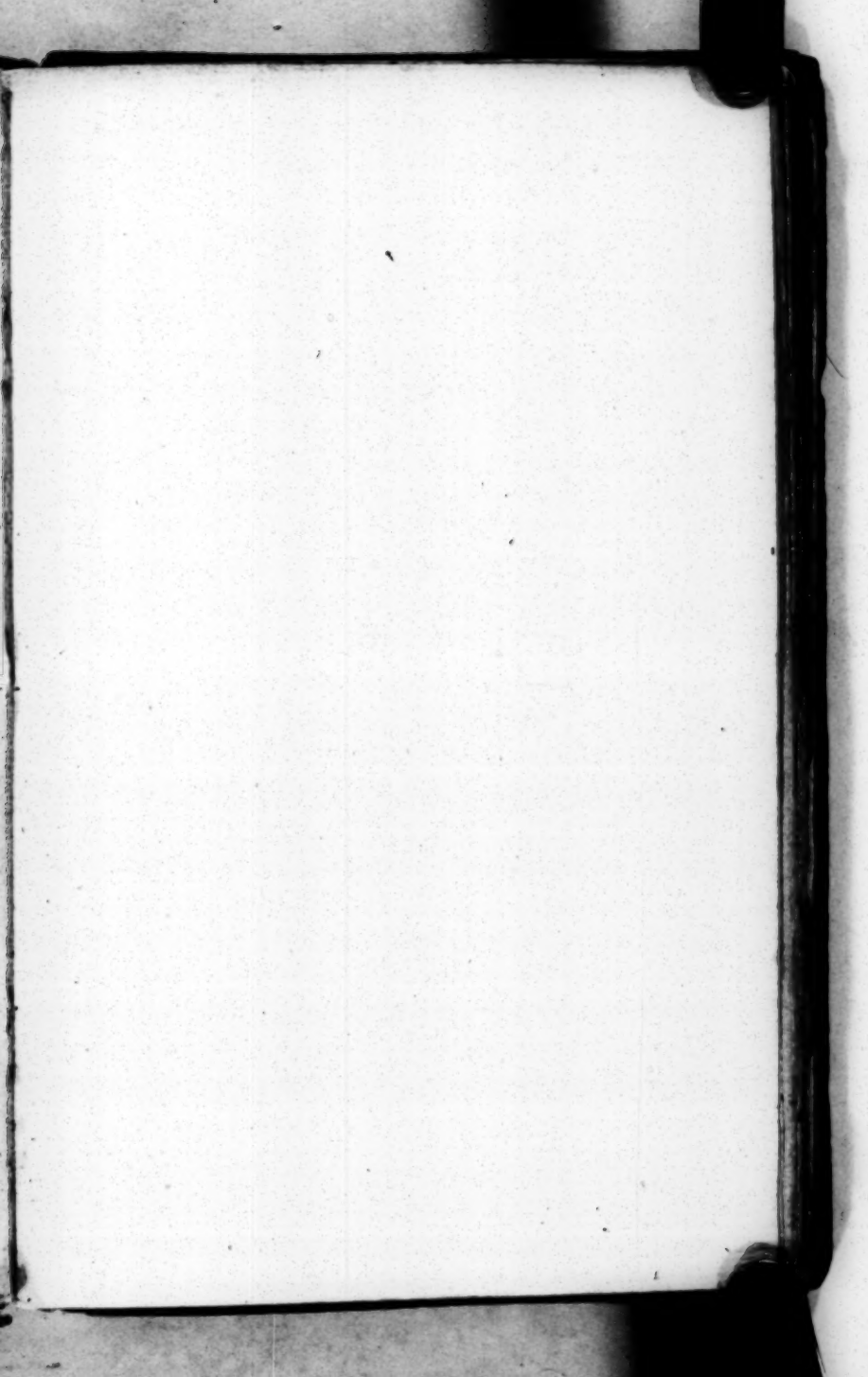
The use of

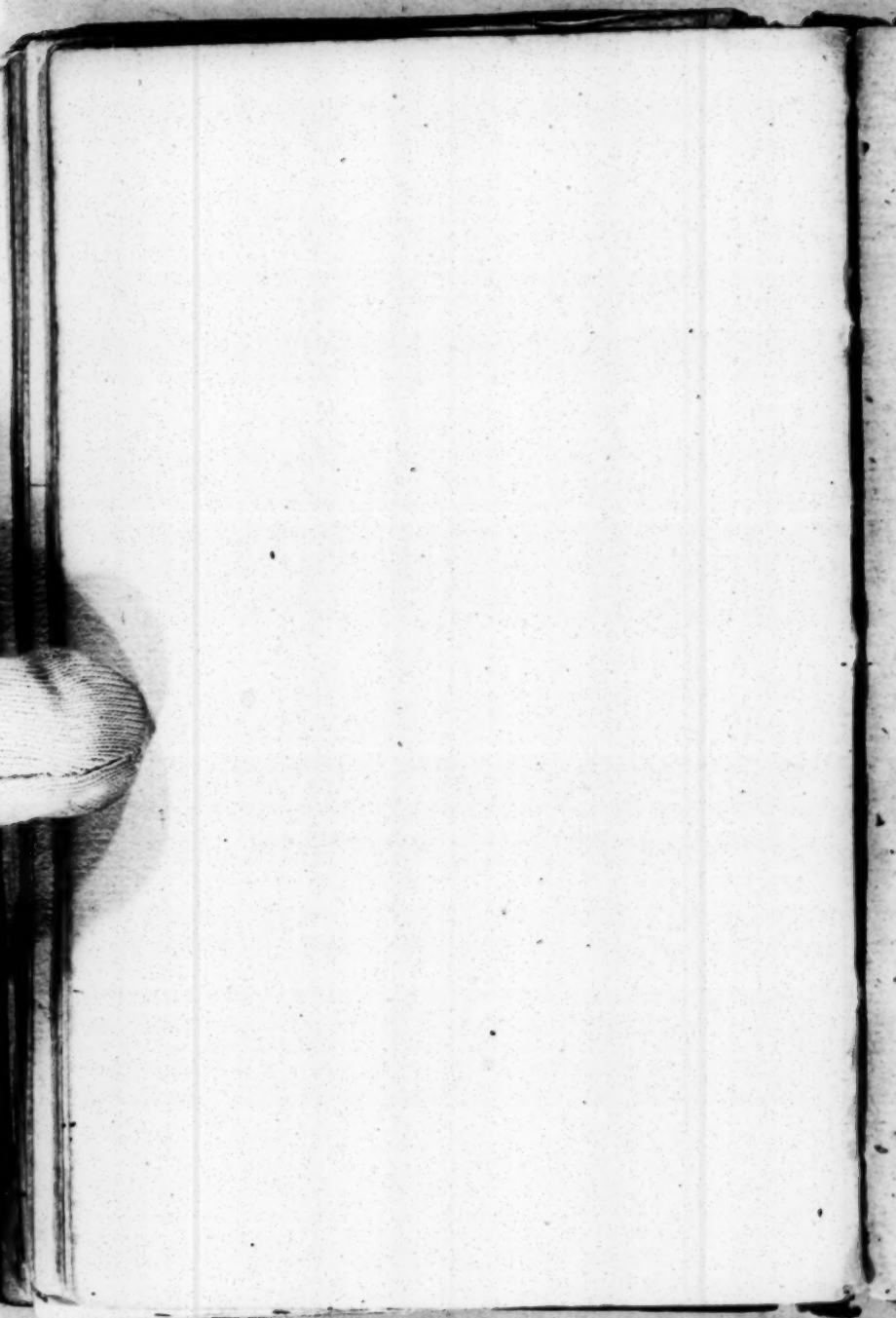
falls upon twelve parts and an half of Right shadow; and the distance I find to be 102 yards one quarter of which is 25 yards and an half, and one yard and an half makes 27 yards, the height of the Steeple.

Now for the parts of Contrary shadow, looking to the top of the Steeple, I find 25 parts of Contrary shadow cut by the thred, and the distance between me and the foot of the Steeple, I find to be 12 yards and an half, which being doubled, make 25 yards and an half, and one yard and an half the length of my body make 27 yards; the height of the Steeple.

Again, I look through the Sights to the top of the Steeple, and find twelve parts and an half of Contrary shadow cut by the thred; and measuring from my foot to the foot of the Steeple I find it 6 yards and 13 inches; which doubling four times, it makes it 25 yards and an half; and one yard and an half added to it, is 26 yards: the height of the Steeple.

Now if standing upon a known height you would know a distance, work as you did before; onely that which was then the parts of Right must now be the parts of Contrary shadow, and that which was then the parts of contrary shadow, must now be the parts of Right shadow. I





I will give you but two examples of this, and let the Reader study the rest by this.

Standing upon a Steeple 27 yards high, let the Quadrant be lifted no higher then is the Steeple; if you do, you must allow so much as it is higher; I look to the root of a Tree, and find the thred to cut 25 parts of that which now is Contrary shadow; therefore doubling the height of the Steeple which is 27 yards, you have 54 yards, for the distance between the foot of the Steeple and the Root of the Tree.

Secondly, Looking to the bottom of an House-wall, I find the thred fall upon 25 parts of that which is now right shadow; then is the distance between the foot of the Steeple and the bottom of that Wall but half the height of the Steeple, which half will come to be 13 yards and an half.

But if looking to a place the thred fall just between Right and Contrary shadow, then is the distance and height equal,

In the taking of distances upon a height, you must do contrary to what you did before; for there you looked first through the Sight furthest from the Center, but now you must look through the Sight next the Center first, and then through the next to the place you observe:

and

and note, that by Heights we speak only of perpendicular or upright Heights, and in Distances only of Levels.

Now follows the use of the **Quadrat** by Arithmetical Operations.

First for the taking of heights: Take any station and look to the top of the Wall, House, Window, Steeple, or Tree, whose height you would know; but get your station as near it as may be: then mark whether the thred fall up on the parts of Right or Contrary shadow; if it fall upon Right shadow, then, as all the parts of Right shadow are to the parts between the thred and the Semidiameter, so is the distance to the height.

But if the thred fall upon the parts of Contrary shadow, then as the parts between the thred and the Semidiameter are to all the parts of Contrary shadow, so is the distance to the height; and of the contrary of these two it holds good, that is, That as in Right shadow as the whole of the parts is to the parts cut by the thred, so the distance is to the height: So on the contrary; As the parts between the thred and the Semidiameter are to all the parts of Right shadow, so is the height to the distance, and in the parts of Contrary shadow it holds true:

That

That as all the parts of Contrary shadow are to the parts between the thred and the Radius, so is the height to the distance. So that observing this for a general rule, it is easie to find any height or distance. I will give two or three examples in both these cases: and first of Right shadow.

I take a Quadrant whose Quadrant hath each divided into 50 parts, and looking to the top of a Steeple, I find the thred to fall upon 7 parts of Right shadow, and I measure to the foot of the Steeple, and find it to be 520 yards; then I say,

As 50 the whole of the parts of Right shadow is to 7, the parts between the thred and Semidiameter, so is 520 the distance given, to 72 Yards, 3 Foot, 4 Inches, the height required.

EXAMPLE. II.

I look to the top of a Tree through the Sights, and find the thred fall upon 44 parts of Right shadow, and from my foot to the foot of the Tree five yards; then I say,

As 50 the whole parts of the shadow is to 44, the parts cut by the thred; so is 5 yards the distance measured to 4 yards, 1 foot, and 2 inches, the height required.

B

Now

Now for the taking of a distance, being upon a known height.

EXAMPLE.

Standing in a Window so that between my Ey and the Ground are nine yards, and looking to the foot of a Tree or House, I find the thred to fall upon 25 parts of Right shadow; then for the distance between the foot of the Tree and the foot of the House, I say,

As 25 the parts whereon the thred falls, is to 50, all the parts of Right shadow; so is 9 yards the height given to 18 yards, the distance required. And alwaies when you stand upon a height to take a distance, you must look through that Sight next the Center first.

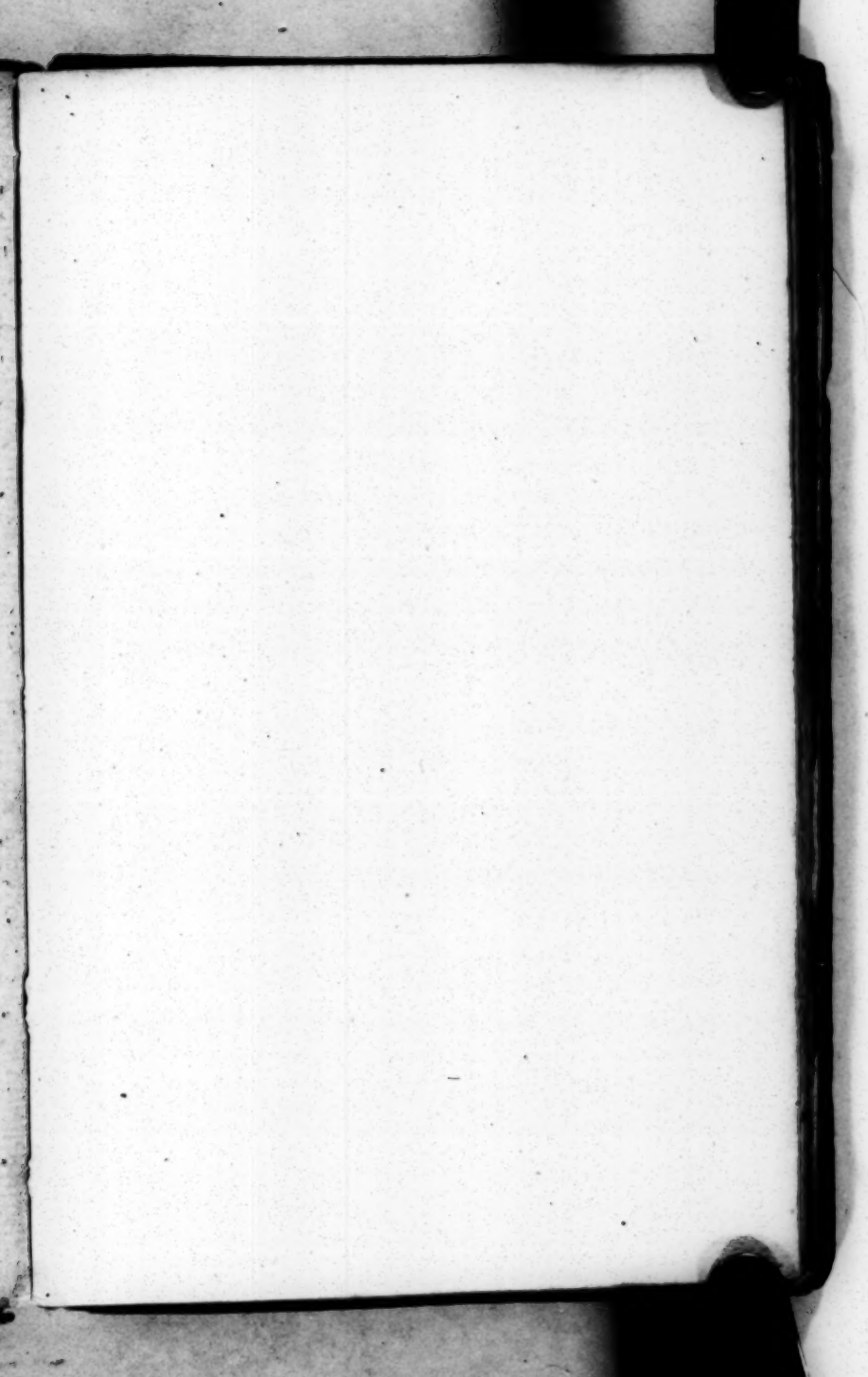
Secondly, for the parts of Contrary shadow.

Looking to the top of a House, I find the thred to fall upon 17 parts of Contrary shadow, and the distance between me and the House I find to be 6 yards: then I say by proportion,

As 17, the parts on which the thred falls, is to 50, all the parts of the shadow; so is 6 yards the distance to 17 yards 2 foot, the height sought.

EXAMPLE.

Standing upon a Tower 50 yards high, I see a Hills foot through the Sight, and the thred





thred falls upon 27 yards of Contrary shadow : therefore I say,

As 50 the whole content of the parts is to 27, the parts cut by the thred ; so is 50 yards, the height, to 27 yards the distance of the place I saw. And so you may do in any case, observing well the general rule laid down before.

It resteth that I speak a little of knowing how to find a Height or a Distance, at two stations, measuring only the distance between them: for sometimes you cannot measure the distance to the Wall, by reason of some hindrance.

For the solution of this, do thus: Work as is before said: onely whereas then you had either the height or distance given, now you must give a guess at the height or distance; and having supposed the distance to be so much; I have before shewed how to find the height: and also having the height supposed, to find the distance. This is laid down before, either when the thred falls upon the parts of Right or Contrary shadow.

Then having taken the height or distance by supposition, take another standing, and make your second observation; and taking the first supposed height for granted, find out your distance,

stance, as is taught before; having so done, you have these four things given; viz.

1. The supposed height.
2. The supposed distance from the first station to the thing you observe.
3. The distance from the second station; and by that.

4. The distance of the two stations one from another: All this is but supposed. Now measuring between the first and second stations I find my errour; therefore all the errors being proportional, I say thus.

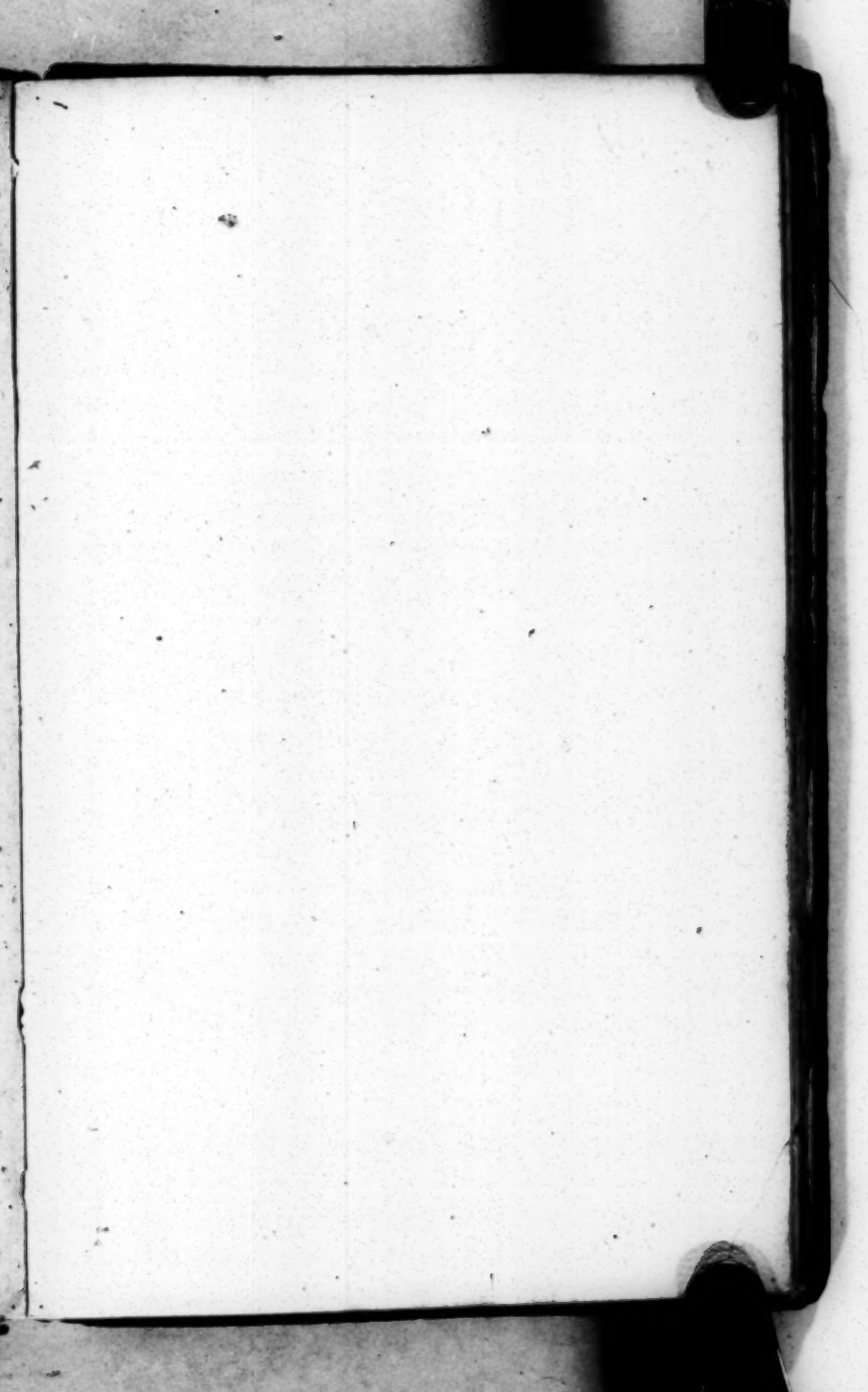
As the supposed distance between the two stations is to the true distance between them, so is the supposed height to the true height: and as the supposed distance is to the true distance of the stations, so is the supposed distance of either station from the thing observed, to the true distance of either station.

Thus you may take the height of a Mountain, or of a House, Tree or any thing, and the true distance between you and the place just under the height you observe.

Now will I give examples of this, and so conclude with the Quadrant.

I would know the height of a Steeple, therefore taking one station, I find the shad fall on 35 parts of Right shadow; and because I can-

not





not measure to the Steeple, because of the unevenness of the ground, or some other impediment, therefore I suppose the distance 40 yards: Then I say,

As 50 the whole parts of the shadow to 35 parts cut by the thred, so is 40 yards the supposed distance to 28 yards, the supposed height.

Then going a little further in a straight Line, so that my first station lie between my second station and the Steeple. I find the thred to fall upon 33 parts of right shadow: Then I say,

As 33 parts cut by the thred, is to 50 the whole parts of the shadow; so is 28 the supposed height, to 42 yards, 1 foot, 3 inches, the supposed distance of the second station: so that the second station is distant from the first station by supposition 2 yards, 1 foot, 3 inches. Now if measuring these distances, I find it to be but 2 yards, 3 inches; Then I say,

As 2 yards, 1 foot 3 inches the supposed distance of the second station is to 27 yards, 3 inches their true distance so is 28 yards, the supposed height, to 24 yards, 4 inches the true height.

Then for the distance, I say,

As 28 yards the supposed height to 24 yards, 4 inches the true height; so is 42 yards 1 foot, 3 inches, the distance of the second station,

station to 36 yards, 1 foot, 7 inches, the true distance of the second station.

Then for the distance of the first station; Take away their difference 2 yards, 1 foot, 3 inches, and the remainder will be the distance of the first station.

Thus ye may do when it falls upon the parts of Right shadow, but if the thred fall upon the parts of Contrary shadow, then do as by this example following.

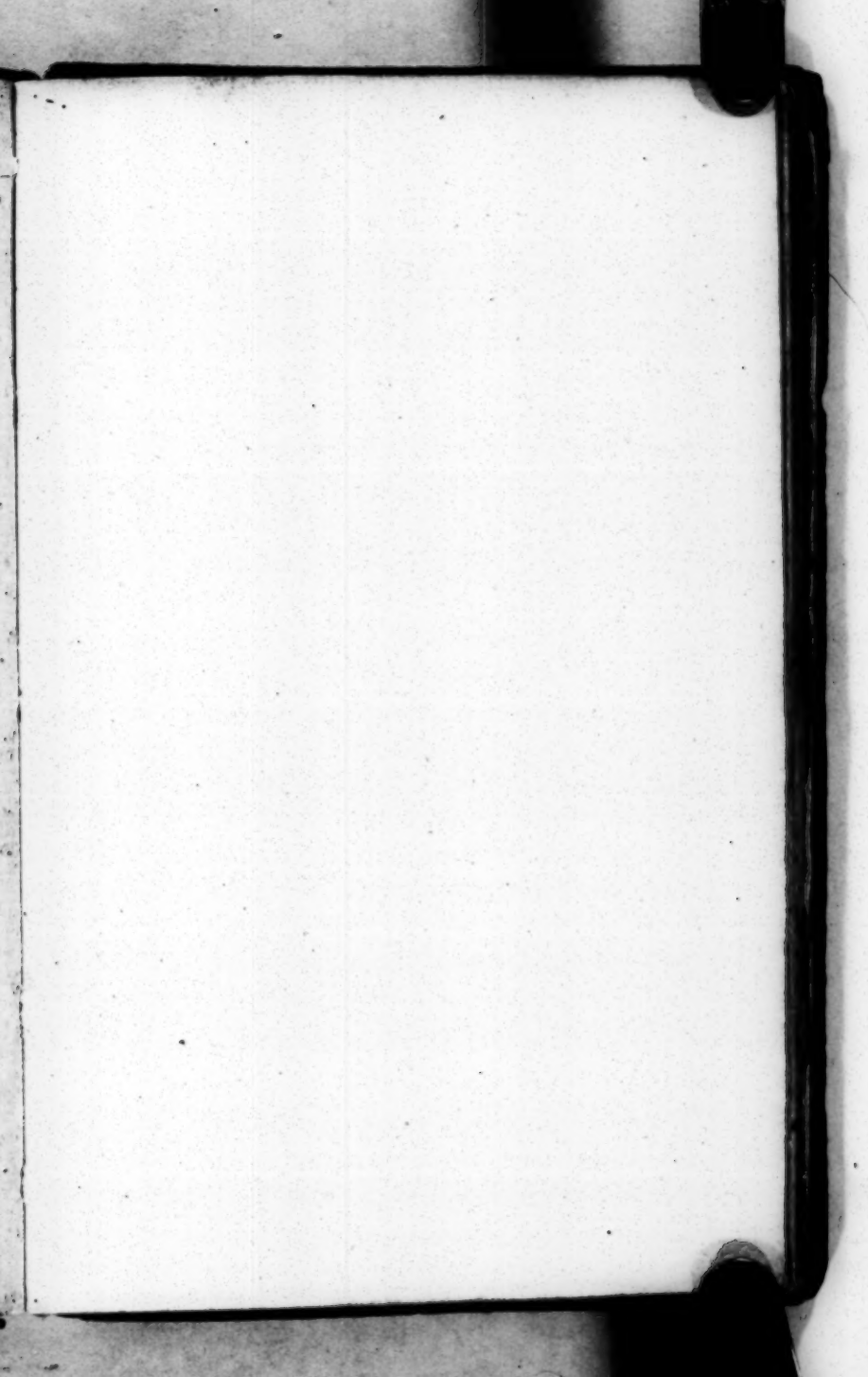
Looking through the Sights to the top of an hill, I find the thred to fall upon 20 parts of Contrary shadow; then suppose the height to be 84 yards, I say,

As 50 to all the parts of the shadow is to 20, the parts cut by the thred; so is 84 yards the supposed height to 33 yards two foot, the supposed distance of the first station.

Then going further off, I make observation, and find the thred to fall upon 22 yards of Contrary shadow: Then for the distance I say.

As 50 the parts of Contrary shadow are to 22 parts, cut by the thred, so is 84 yards the supposed height to 34 yards, 2 foot, 10 inches, the supposed distance of the second station: so that the difference by supposition between the two stations, is 1 yard and 10 inches.

Now





Now if I measure the distance of the two stations, I find them to be distant three yards; I say first for finding the true height;

As 1 yard 10 inches, the supposed difference of the two stations, is to 3 yards their true difference; so is 84 yards the supposed height to 197 yards 7 inches the true height.

Therefore for the distance I say

As 1 yard 10 inches the supposed distance of the stations is to 3 yards their true distance; so is 3 yards, the supposed distance of the first station to 77 yards, 1 foot, 5 inches, the true distance of the same first station: To which if you add 3 yards, you have 80 yards, 1 foot, 5 inches, the distance of the last station.

And in the working of this, let the Reader be very exact. First in his Observations; Secondly, in his Calculations; and then he need not doubt but his work will come true and right.

This might have been exceedingly illustrated, if prolixity had been affected; but I doubt not but by this a carefull Student will accomplish any question either of the Heights or Distances of things; or in taking the Altitudes of the Sun, Moon, or Stars: And in thy reading, if any thing seem dubious unto thee

look forward or backward, and then thou wilt by comparing one thing with another, find out the real truth.



SECT. II.

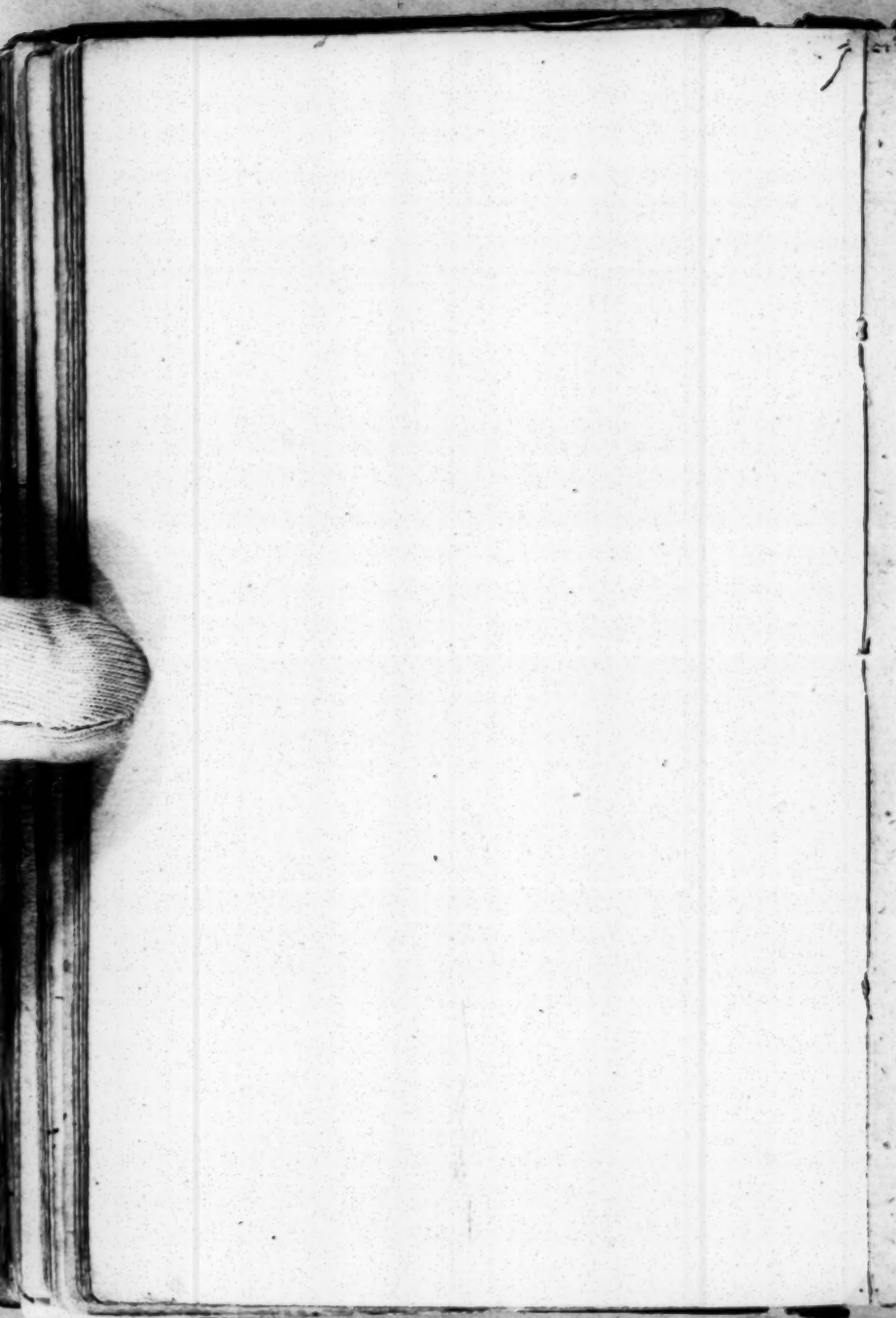
Shewing the use of Hour-lines, and Azimuth-lines, &c.

BEcause the Quadrant and Quadrant fills not up the Instrument, but that there is vacant places left without any inscription; therefore many knowing men have invented several Lines, &c. to fill them up with.

And first of all, *Stophler* (in his *Elucidatio Fabricæ usque Astrolobij*) teaches to make Hour-lines for the time of the day; yet he describes them in his Quadrant in such an imperfect manner, that it is plainly to be seen he rather affected ease, then truth.

Since him, *M. Gunter* hath invented Hour-lines, after a more perfect way, and also illustrated the Quadrant with Azimuth-lines, and a Scale of the days of the Month, and Arches
of





of the Horizon, and the Ecliptick line, and also the Places of some notable Stars that lie between the Equator and Tropick.

Others have also have exercised their wits in inventing several Conceits to fill the Instrument up with; as namely *M. De le Main*, *M. Outred*, *M. Foster*, *M. Scirup*, *M. Dayr*, &c. All different one from the other, as I shall hereafter shew in convenient place.

But first I shall shew you the use of divers Lines that *M. Gunter* hath described in his Quadrant: and though they be sufficiently and learnedly handled by himself in his Book; yet I think it not amiss to make them plain and easie to be understood of such as are not otherwise Mathematically given; but only desire to know the use of the Quadrant, &c.

And therefore I shall begin with the Circle of Moneths, which you shall find described just within the Limb, in 4 Arches of Circles; one end of them reaching to 62 Degrees of the Quadrant, and the other to 15 Degrees of the Quadrant.

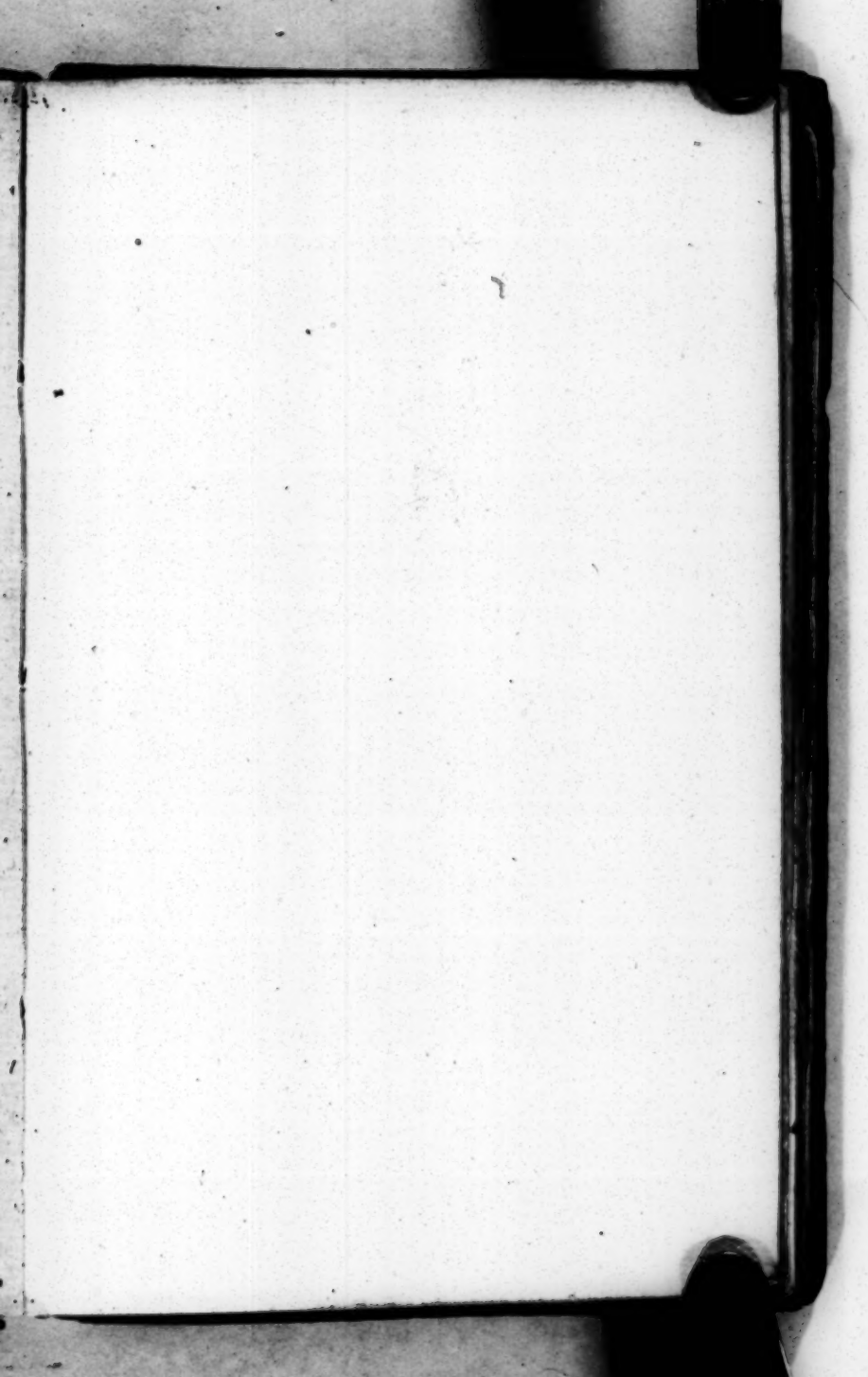
The two next the Quadrant or Limb, are from the tenth of *June*, till the eleventh of *December*; all which time the days shorten to us who live under the North Hemisphear: and in the same time the Sun goeth from the beginning

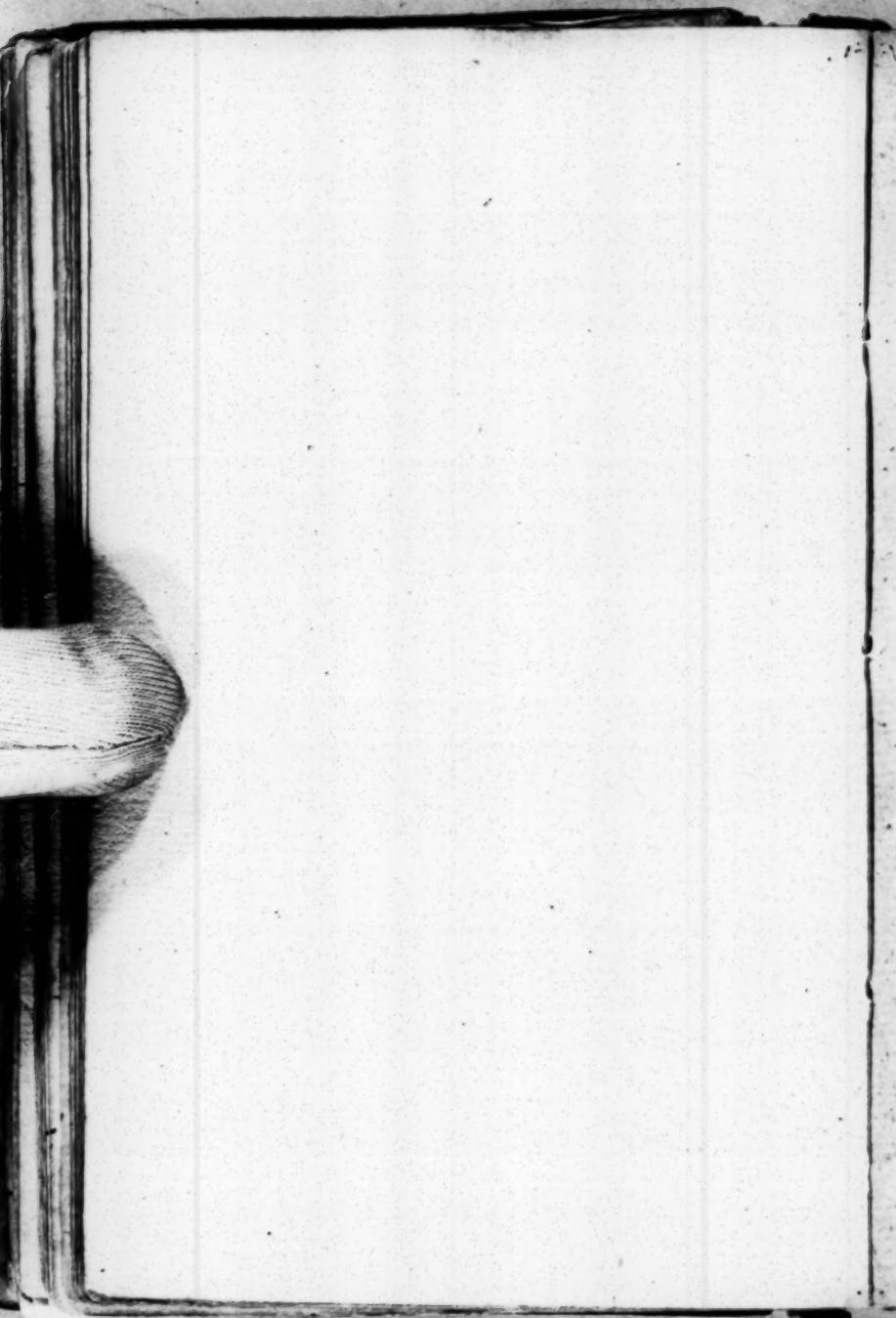
ning of \mathfrak{S} to the beginning of \mathfrak{V} . The other two Circles do contain the other half of the year; that is, from the eleventh of *December*, to the tenth of *June*: each Moneth at the beginning of it is noted with the first letter of that Moneth; as J F M A M J J A S O N D: That is *January, February, March, &c.*

Each of these Moneths is divided into every fifth day, or every particular day, as the largeness of the Instrument will bear it, by a small stroke drawn cross the two Circles; and those strokes that extend themselves on the one side to the Limb, and on the other side to the Circle next above them, note the beginning of a Moneth; and at that stroke is set the letter that notes the Moneth that begins.

Secondly, Next to this Circle of Moneths towards the Center, where the thred is fastned is a Circle (or rather an Arch of a Circle) drawn from one Semidiameter to the other; and this is called the Tropick, and serveth in its use both for the Tropick of \mathfrak{S} or \mathfrak{V} : at one end you may find this Arithmetical Figure 8; and at the other end these two Characters of \mathfrak{S} and \mathfrak{V} .

Thirdly, That Circle which you see part of is covered by the Quadrat, and hath these Figures upon it, 6. 7. 8. 9. 10. 11. 12. 30. 60.





60. 90. is the Equator or Equinoctial : It is drawn from one Semidiameter to the other, and is nearest the Center of any other of the Circles.

Fourthly, That three-lined Circle which is drawn from the Figure 6 in the Equator to the end of the Tropick and is divided into three times 30 divisions is the Ecliptick ; and upon it are put the Characters of the twelve Signs of the Zodiack thus, $\gamma \approx \pi \times \delta$
 $m \text{ Q } \approx \pi \text{ I } \text{ S } \text{ V}$; but you must read them in due order, as shall be shewed hereafter.

Fifthly, From 6 in the Equator to the latter end *February* in the Circle of Moneths, is drawn an arch of a two lined Circle and is divided into parts as the Ecliptick is; and is numbred from the Equator to the Tropick : This Circle is called the Horizon.

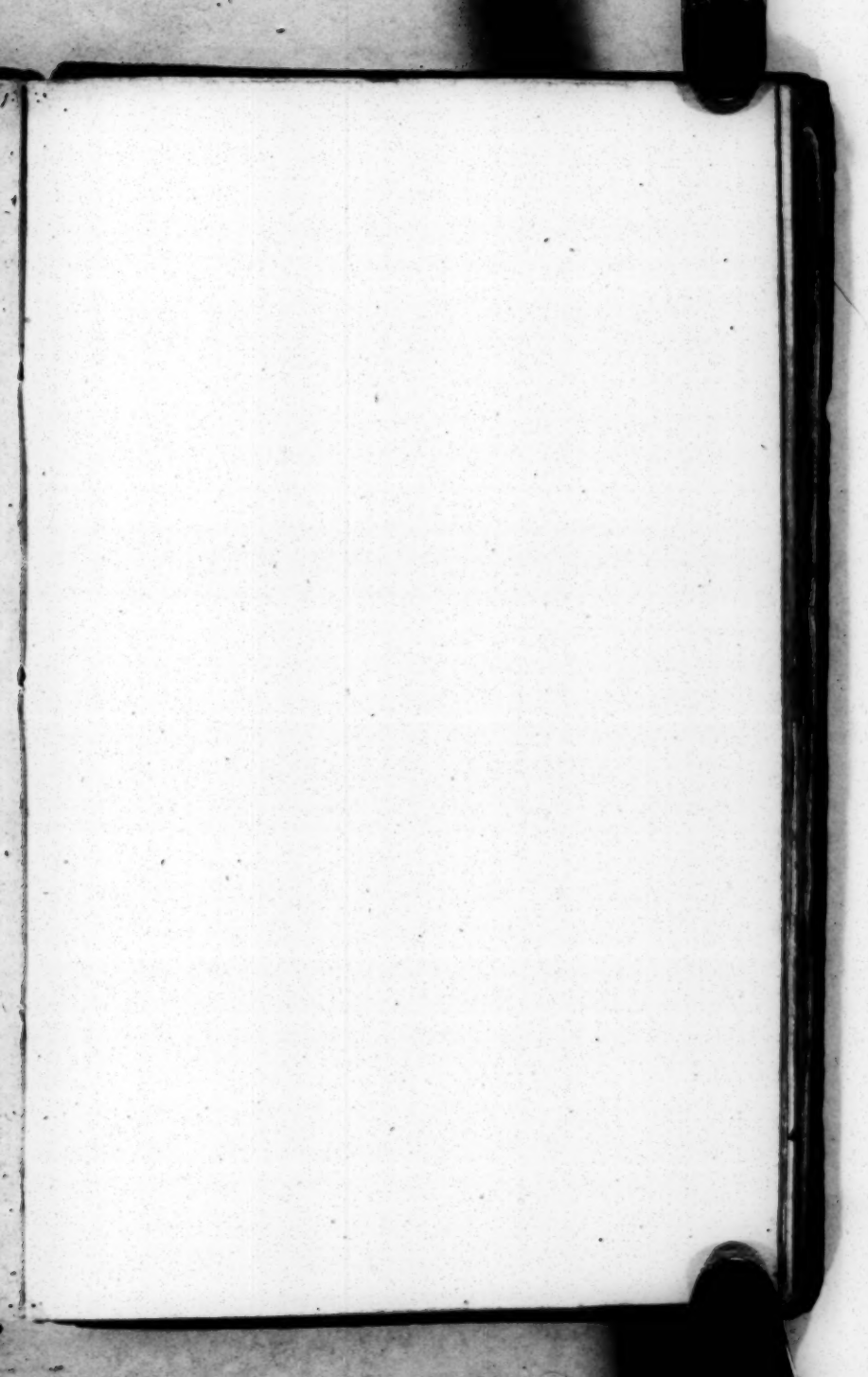
Sixthly, From the Equator to the Tropick upon the Semidiameter, is a division of 23 equal parts, and one half of a part; numbred 10 and 20 : This is called the Line of Declination.

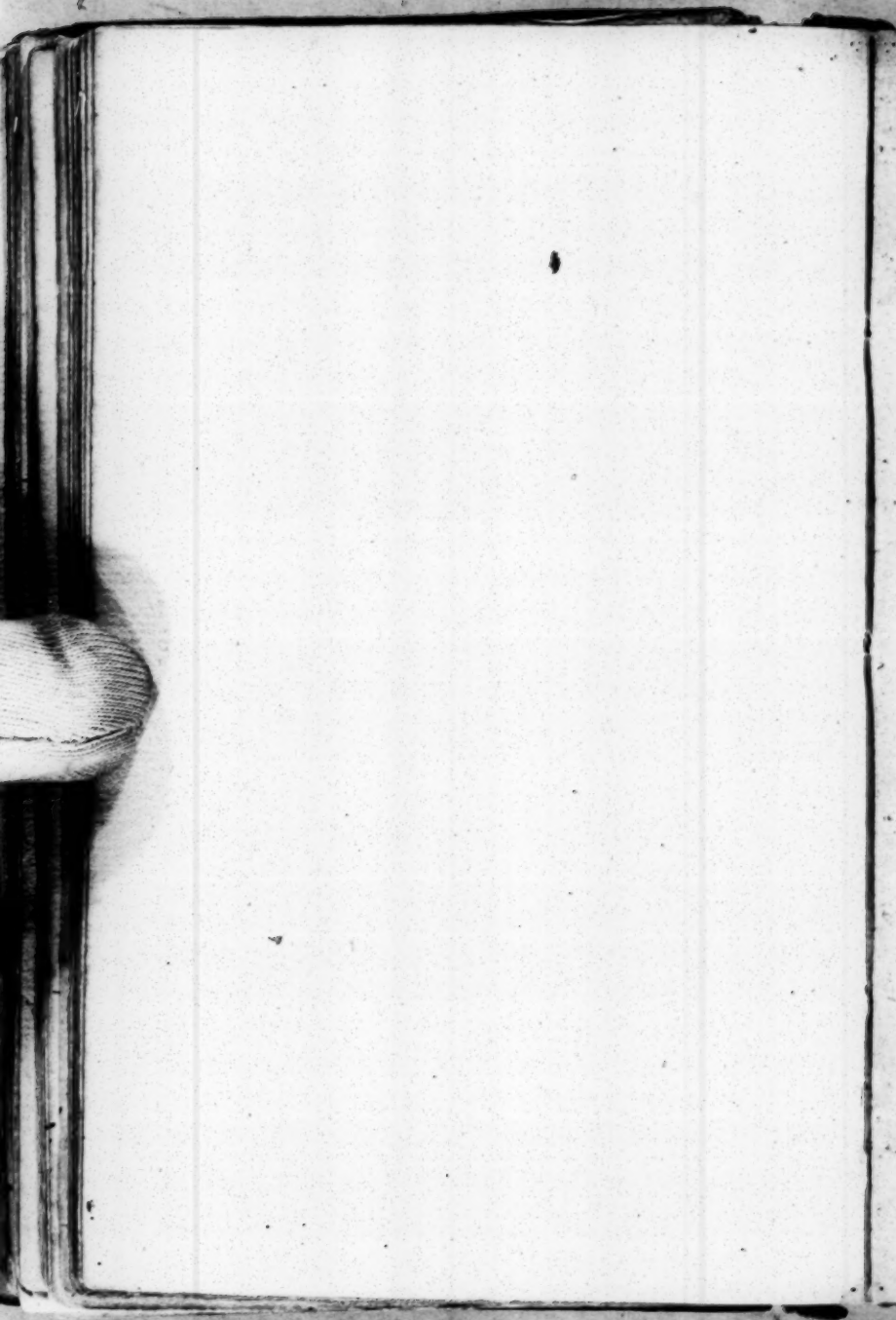
Seventhly, From 7. 8. 9. 10. 11. 12. in the Equator, are drawn six Lines, bending towards the Line of Declination ; and again, from 22 and 12 parts in the Line of Declination; and so from 6. 7. 8. 9. 10. 11. 12. in the Equator, and bending

bending from the Line of Declination, and are nine in number : These crossing the other that bend towards the Line of Declination, are all of them called the Hour-lines. And here note, That that Hour-line which is drawn from 12 in the Equator, to the Tropick just over *June* in the Circle of Moneths, is the bounds of the Hour lines. Between every two Hour lines are drawn touches of lines thus — — — for the half Hour-lines and between every half and whole Hour-line is drawn prickt lines thus , for the quarter Hour-lines.

Eightly, All those Circles drawn on the other side, of which I have said nothing yet, are the Azimuths, and are numbred by tens with 10, 20, 30, 40, 50, 60, 70, 80, 90. in the Equator; and with 100. 110. 120. upon the Semidiameter : and between every tenth Azimuth are drawn touches of lines thus — — — representing every fifth degree of Azimuth. The number of them drawn bending towards the Line of Declination, is 26; and those drawn bending the other way are 18 in number.

Ninthly, Ye may see *Peg. wing*, or *Pegasus wing*, and *Arctus*, or *Arcturus*: and *Cor A*, or the *Lions heart* : and the *Bulls ey*: and the *Vultures heart* : Each having placed by them





a Star thus, * which are the names of five Stars, which are all between the Equator in the Heavens and the Tropick of S : and to each Star is set down the day of the Moneth and Hour that it comes to the South.

Tenthly, The Sights, which are two peeces of Brass, with two little holes in them, to look thorow, or to let the Sun shine thorow; and these Sights are placed upon one of the Semi-diameters.

Lastly the Center, where the thred is fastned. Besides this it must have a Plummert, and a Bead, upon the thred.

Note that this is the description of a large Quadrant lately engraven and Printed by M. Moxon; and by him very accurately passed on a Board, and fitted up with Sights and a Bead, &c.

The use of the Circle of Moneths, Ecliptick, Horizon, Line of Declination, Hour-Lines, Azimuths, and the five Stars, are briefly as followeth.

First the Use of the Circle of Moneths.

TO find any day of the year required, first look out the Moneth; and then from the beginning of it count at the first cross stroke five days (unless the Moneths be divided

ded into particular days, and the next stroke five more, that is ten days; till you come at the day you look for.

EXAMPLE.

I would find the seventeenth day of *November*; then having found N for *November*, I count towards *December*, that is, towards D; and say, 5, 10, 15, 20: therefore between 15 and 20 must be 17, So I guess at the seventeenth day, and lay the thred upon it, and find it to fall upon 17 Degrees and an half in the Limb. Now in *June* or *December*, 'tis hard to find the day of the Moneth, or to seven or eight days; but all the rest of the year it is easie enough.

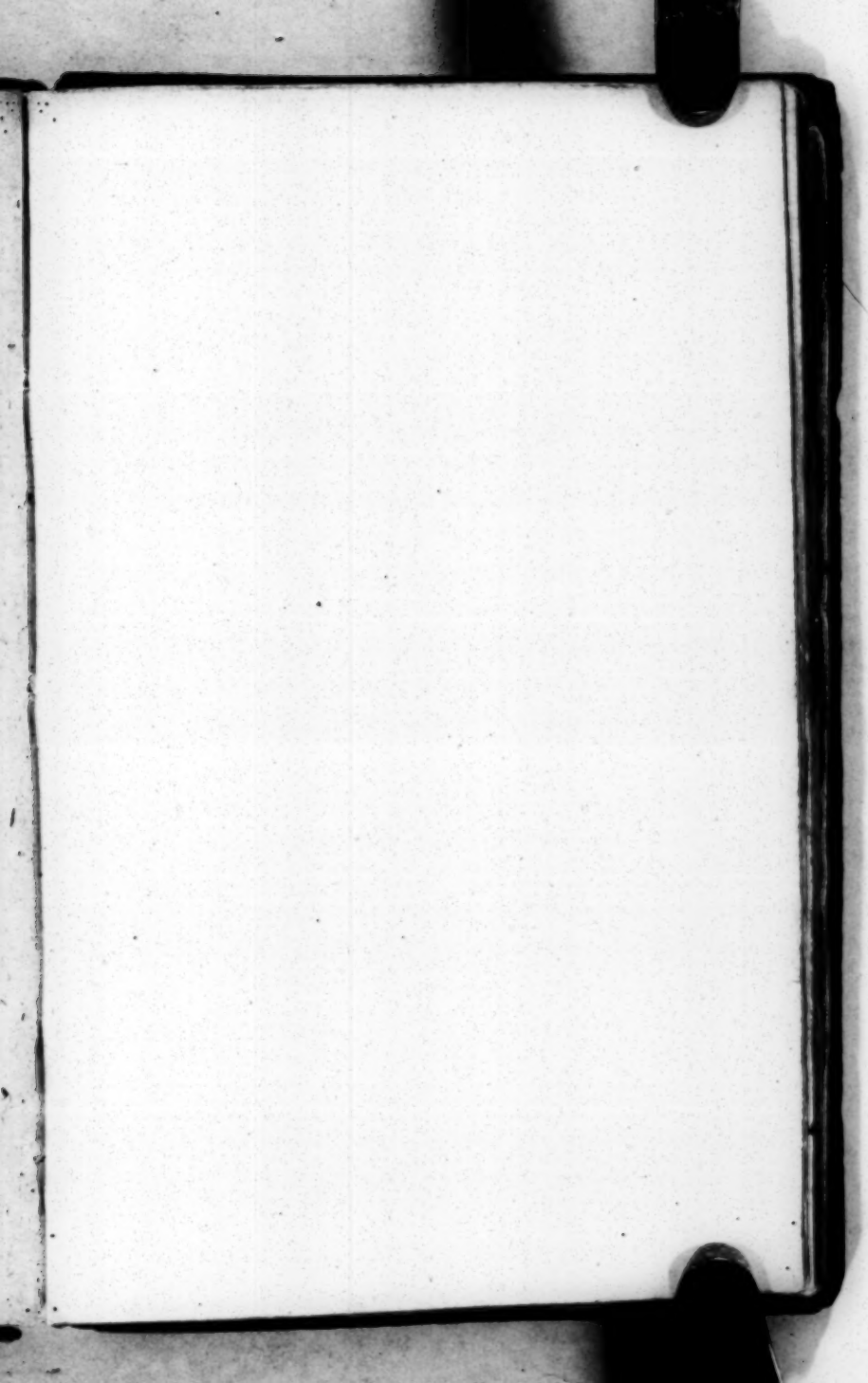
2. Having found the day of the Moneth, to find how high the Sun will be at Noon.

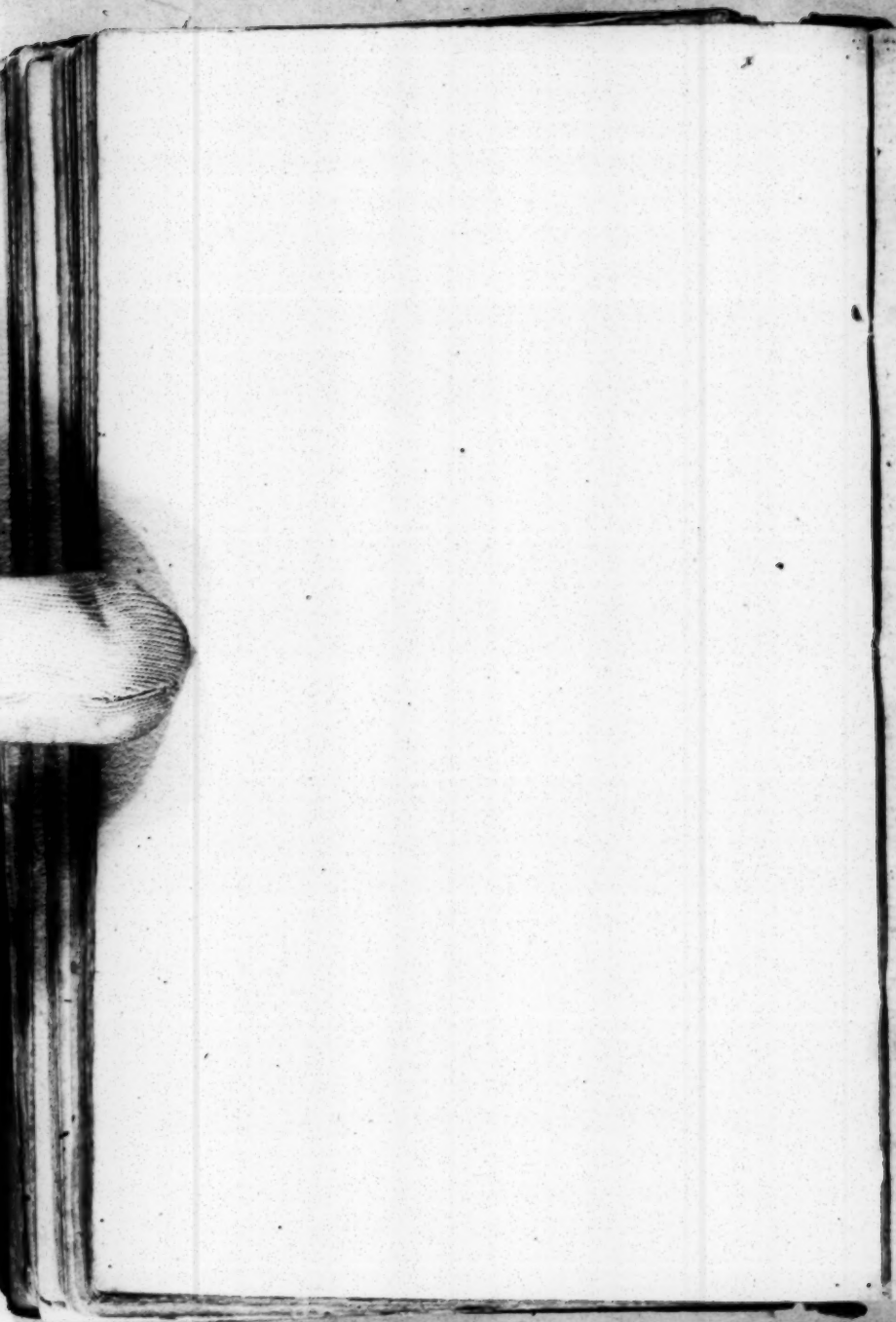
Lay the thred upon the day of the Moneth, and the Degree cut by the thred in the Limb, is the Meridian Altitude, or the height of the Sun at Noon; so the height of the Sun upon the eighteenth day of *May*, you will find to be 41 Degrees 45 Minutes.

3. Thirdly, to find what days of the year are of equal length.

Lay the thred upon the day given, and on the other side it will fall upon the day equal in length to that.

EXAM.





EXAMPLE.

I desire to know what day is just as long (or as short) as the eighteenth of *March*, I lay the thred to the eighteenth of *March*, and on the other side it falls upon the fifth day of *September*; so that these two days are both of a length, and the height of the Sun at Noon upon either of them is 41 Degrees 45 Minutes.

Note that the height of the Sun at Noon here given is true onely at the renowned City of *London*, or at any place that lieth due East or West from it; but in any place that is 70 Miles more North then East or West of *London* to them, the Sun will be a degree lower then by the Quadrant (fited for *London*) will appear; but if you be 70 Miles South of *London*, then will the Sun be a Degree higher then the Quadrant will shew; and so allowing 70 Miles for a Degree, you may make this Quadrant universal in this thing.

4. If you have the height of the Sun at Noon, you may find the day of the Month; but this is difficult to do it truly.

Secondly, *The Use of the Ecliptick Circle.*

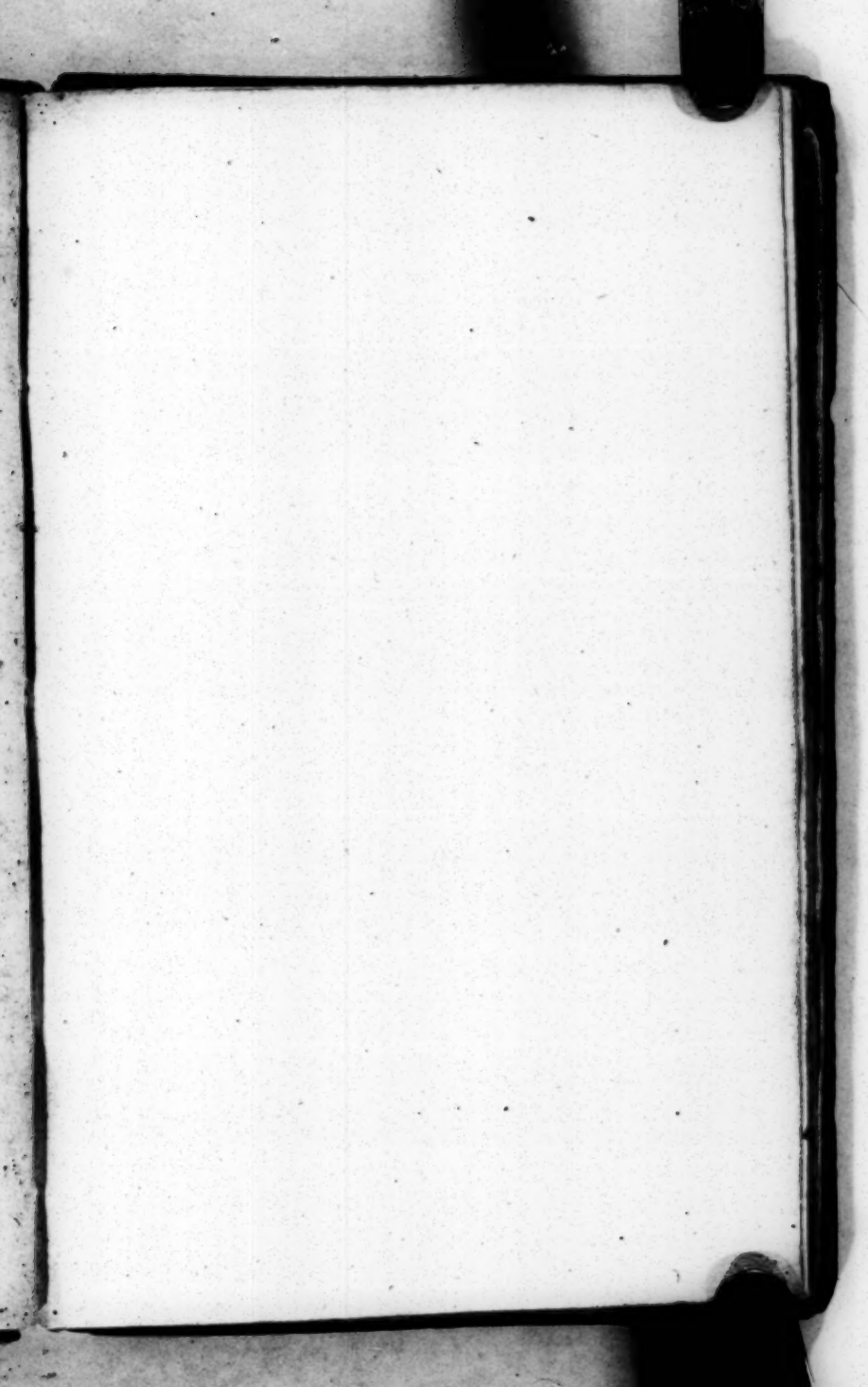
THIS Circle as is before said, is drawn from fix in the Equator, to the other side of the Tropick, and is divided into each single Degree;

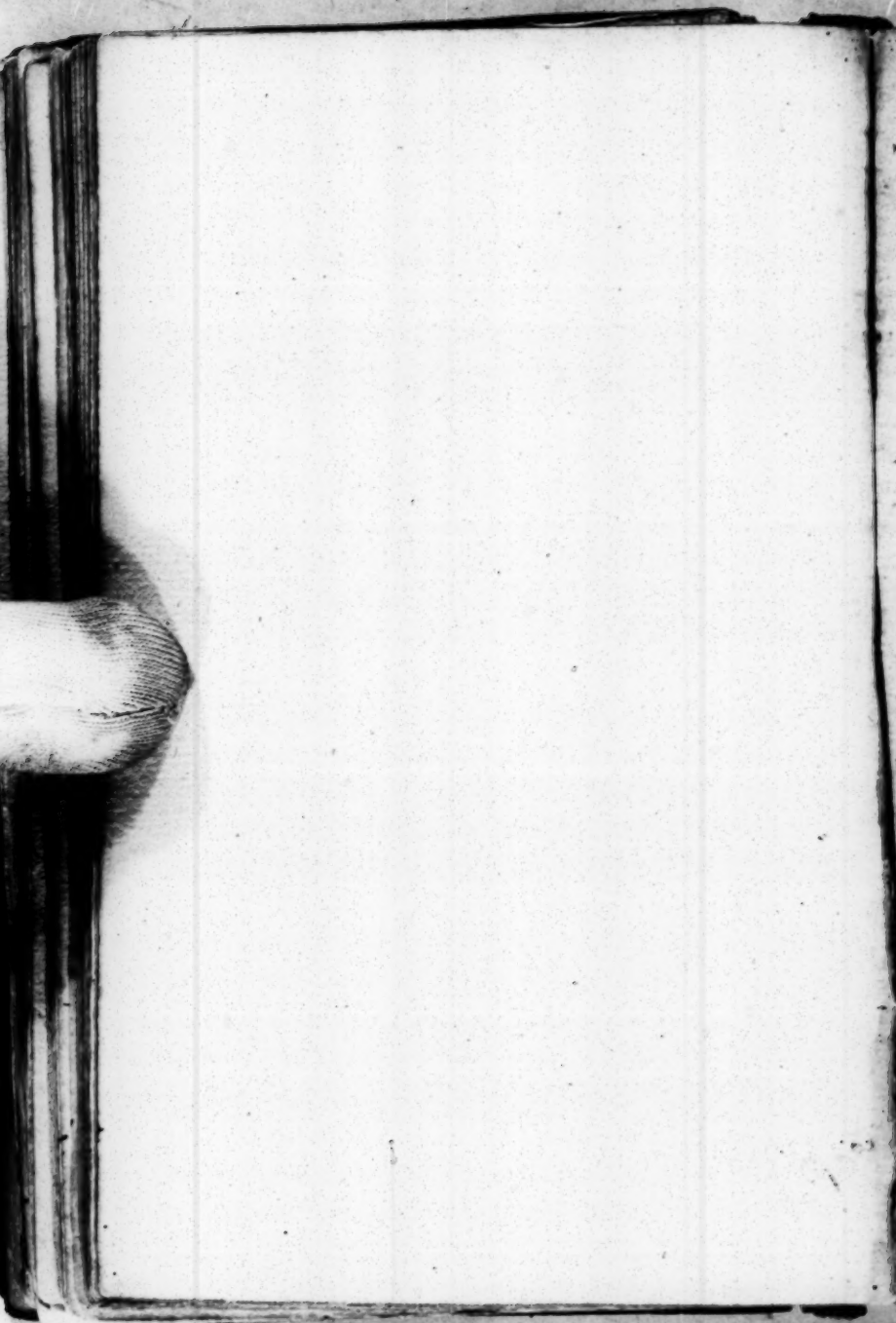
gree; and at the beginning of each signe is a long stroke; and at every tenth Degree a stroke a little shorter; and each fifth Degree with a shorter stroke. Now upon this Arch are the Characters of the twelve signs, which you must now follow one another in this order, γ δ Π β α ϖ ϵ ζ η θ ι κ ; and these twelve signs answer to the twelve Moneths of the year, and do proceed on in order.

And here is to be noted. That the Sun enters γ upon the tenth of *March*, and δ the tenth of *April*, and so of the rest; so that in *February* the Sun will be found to be in κ . Now I shall shew you how to set your Bead for any day, which must be done thus:

From twelve in the Equator to the end of the Circle of Months, is drawn an Hour-line; and from the same twelve in the Equator, to the other end of the Circle of Months, is drawn another Hour-line.

That which falls upon *December*, is the Hour-line of twelve in the Winter; and the other the Hour-line of twelve a clock in the Summer: Now lay the thred upon the day of the Moneth, and move the Bead up or down, till it lie just upon one of these two Lines, and so is your Bead rectified for that day.





day. So upon the 18 of *March*, bring the thred to the day of the Moneth, and move the Bead up or down, till it falls upon the Hour-line of twelve in the Summer.

How to find these three things following upon the 18 of March.

1. *To find the Suns place in the Ecliptick.*

Having rectified the Bead, as before, Bring it to the Ecliptick, and it will fall upon the Degree the Sun is in that day: so upon the 18 of *March* I find the Sun to be in 8 Degrees of γ ; and upon the 17 of *October*, I find it to be in 3 Degrees of m , m being the Signe answering to *October*. And so by the contrary; If you know the place of the Sun you may find the day of the Moneth.

2. *To find the Suns Declination.*

Having rectified the Bead as before, bring it to the Line of Declination, and it will shew you the Declination of the Sun for that day: Thus upon the 17 of *October* I find the Sun to have 12 Degrees Declination; and upon the 18 of *March*, it hath three Degrees and an half Declination: And note, that if the Bead fall upon the Winter twelve a clock Line, then is the Declination South; but if the Bead fall upon the Summer Line of twelve a clock, then the Declination is North; and by the same

way if you have the Suns Declination given, you may find his place in the Ecliptick, and the day of the Moneth.

2. *To find the Right Ascension of the Sun.*

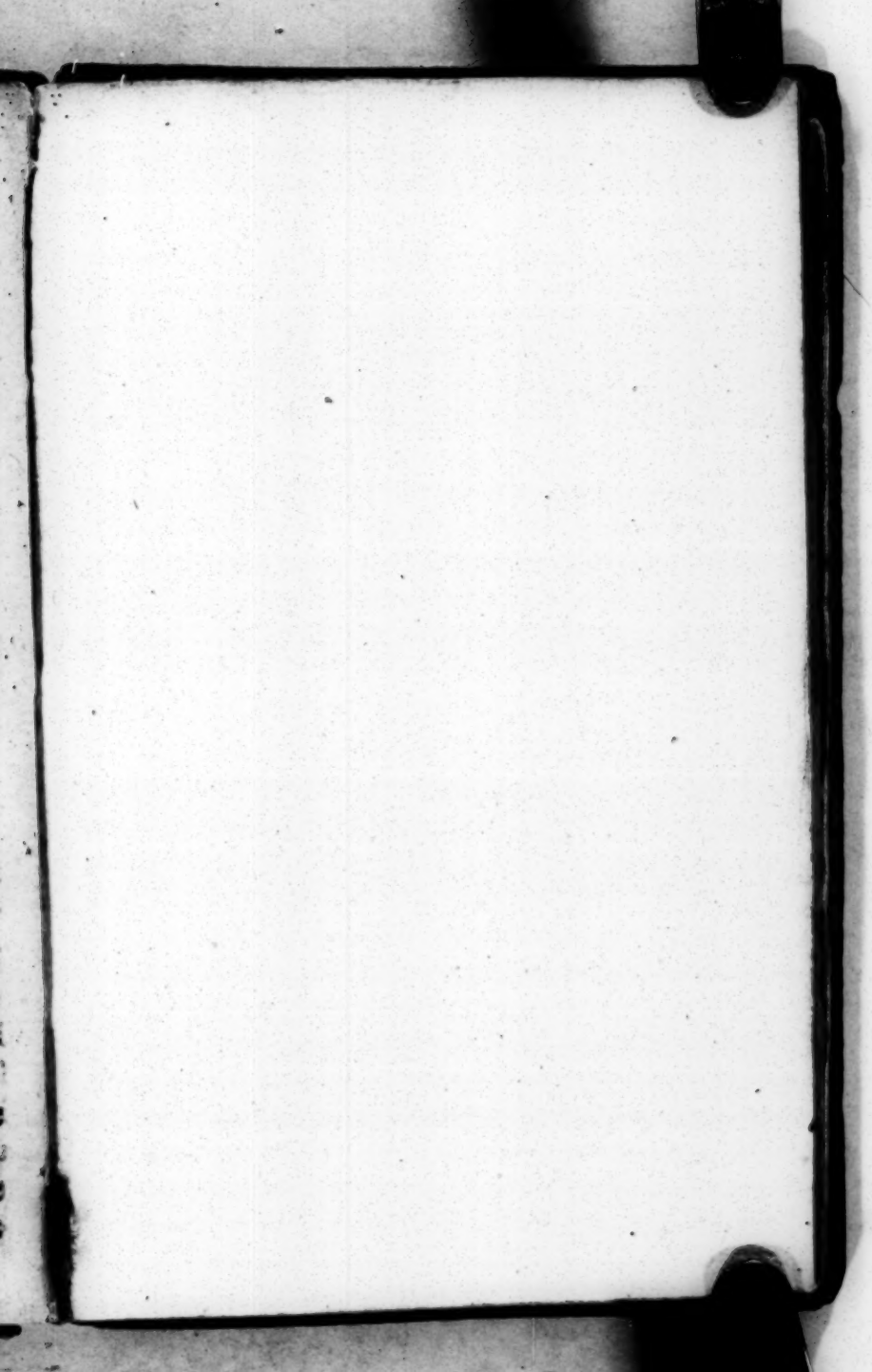
Having rectified the Bead, bring it to the Ecliptick, and the Degrees cut by the thred in the Limb, is the Right Ascension: But when the Sun hath gone three Signes from γ , for every three Signs you must add 90 Degrees to the Right Ascension cut in the Limb; and then have you the Right Ascension. Thus upon the 18 of *March* the Right Ascension is 12 Degrees; and upon the fifth of *August* 126 Degrees; and upon the 10 of *October* it is 208 Deg. and upon the 9 of *March* it is 360 deg.

Thirdly, *The use of the Horizon Line.*

THis double-line is divided into 40 parts; and numbred with 10, 20, 30, 40. The uses of it are three, viz.

1. *To find the Suns Amplitude, or his Rising or Setting from the true East or West point of the Compass, in the Horizon of London.*

Having rectified the Bead, bring it to the Horizon, and it will shew the Amplitude. Thus upon the 9 day of *April* the Amplitude is





is 19 Degrees toward the North: And note that from the 10 of *March*, to the 11 of *September*, it hath North Amplitude; but all the rest of the year, the Amplitude is South.

2. To find the *Ascensional difference*.

Rectifie the Bead, and bring it to the Horizon, and the Degrees cut in the Limb shall be the *Ascensional difference*: Thus the *Ascensional difference* the 9 of *April* is 15 Degrees; and having the *Ascensional difference*, 'tis easie to find the time of Sun-rising and Setting; and thereby the length of the day and Night.

For the time of Sun-rising.

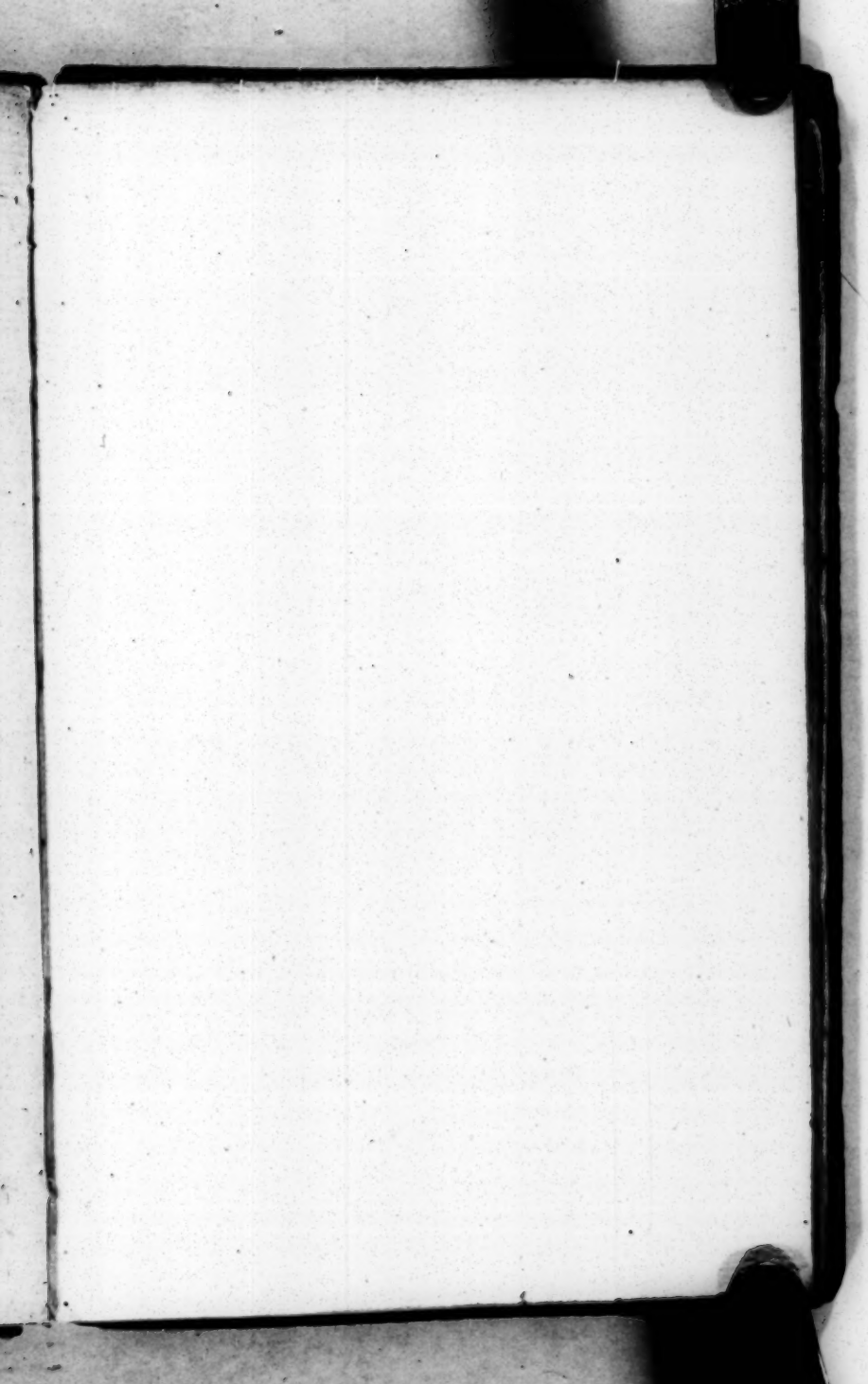
Find out the *Ascensional difference*, then if the time be between the tenth of *March*, and 11 of *September*, allow for each Degree of *Ascensional difference* 4 Minutes of Time; for so much doth the Sun rise before 6 in the Summer, and after 6 in the Winter.

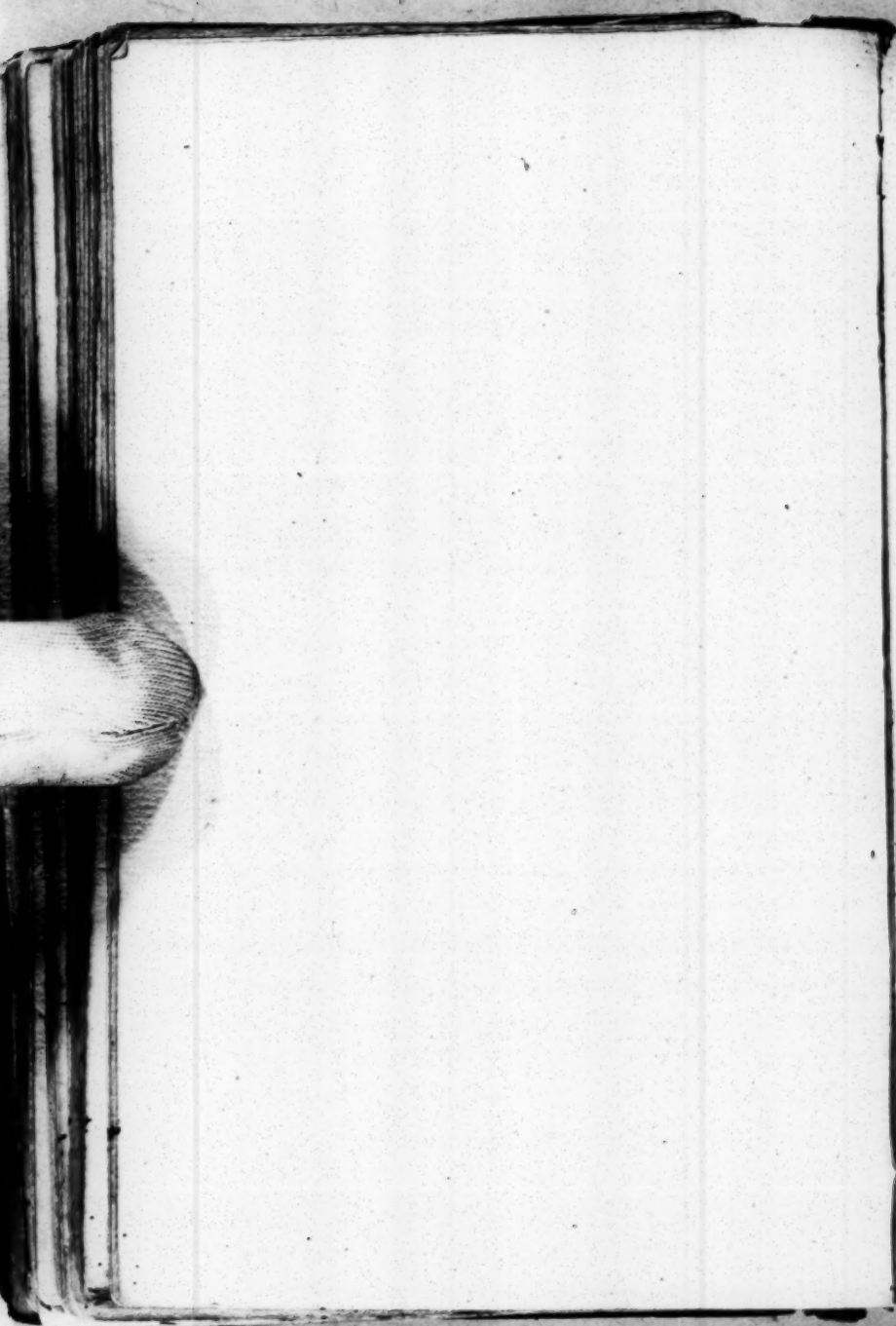
So upon the 9 of *April* I have 15 Degrees of *Ascensional difference*, which is 15 times 4 Minutes; that is just an hour: Now because 'tis in the Summer, I say the Sun riseth an hour before 6 in the morning, that is, at 5 a clock in the morning. And note that so much as the Sun rises before 6, so much it sets after 6; and so much as it rises after 6, so much it sets before 6.

To find the length of the day is easie ; for counting the time from Sun-rising till Noon the same day, I have 7 hours ; and the Afternoon being alwaies the same length as the Forenoon is of, gives me 7 more ; which added together, makes 14 hours for the length of the day ; which taken from 24 hours, leaves 10 hours the length of the night. Thus ye may find the time of Sun-rising and setting, and the length of the day and night, to a Minute of Time.

Fourthly, *The use of the Hour-lines.*

THose Lines that are drawn from 6 7 8 9 10 11 12 in the Equator, bending towards the Line of Declination, are the hours of the day in the Winter, and of the night in the Summer ; and they are numbred first in the Equator, to shew what hour they do belong to : And again they are numbred above the Tropick. The other Hour lines drawn bending from the Equator, are the hours of the day in the Summer, and of the night in the Winter ; they are numbred in the Equator, and in the Tropick ; so that the first drawn from 12 in the Equator to the end of June, is 13 a clock at Noon in Summer, and 12 at Night in Winter ; the next is 11 or 1 a clock before Noon in





in Summer, and 11 and 1 a clock at night in Winter; and so you may find out all the rest, as by the ensuing particulars will more plainly appear.

Having the height of the Sun, to find the Hour of the Day.

First rectifie your Bead, then take the Altitude, and the Bead will fall upon the hour of the day; As for example :

I rectifie the Bead upon the 9 of *April*, and taking the height of the Sun, I find it 31 Degrees high, and the Bead at that observation fell just half way between the Lines of eight and nine in the Equator, and three and four at the Tropick; so that it is half an hour past 8 in the Morning, or half an hour past three in the Afternoon: now if the Sun rises higher, it is before Noon; but if it descend lower and lower, then 'tis Afternoon.

And so by the same way upon the first of *November* I make observation, and the Bead falls half way between 8, and 9, and 3, and 4. in the Winter Circles; therefore 'tis half an hour past 3 in the Afternoon, or half an hour past 8 before Noon: and thus with a little diligence you may find the hour of the day to a small matter.

To know how high the Sun will be at any Hour.

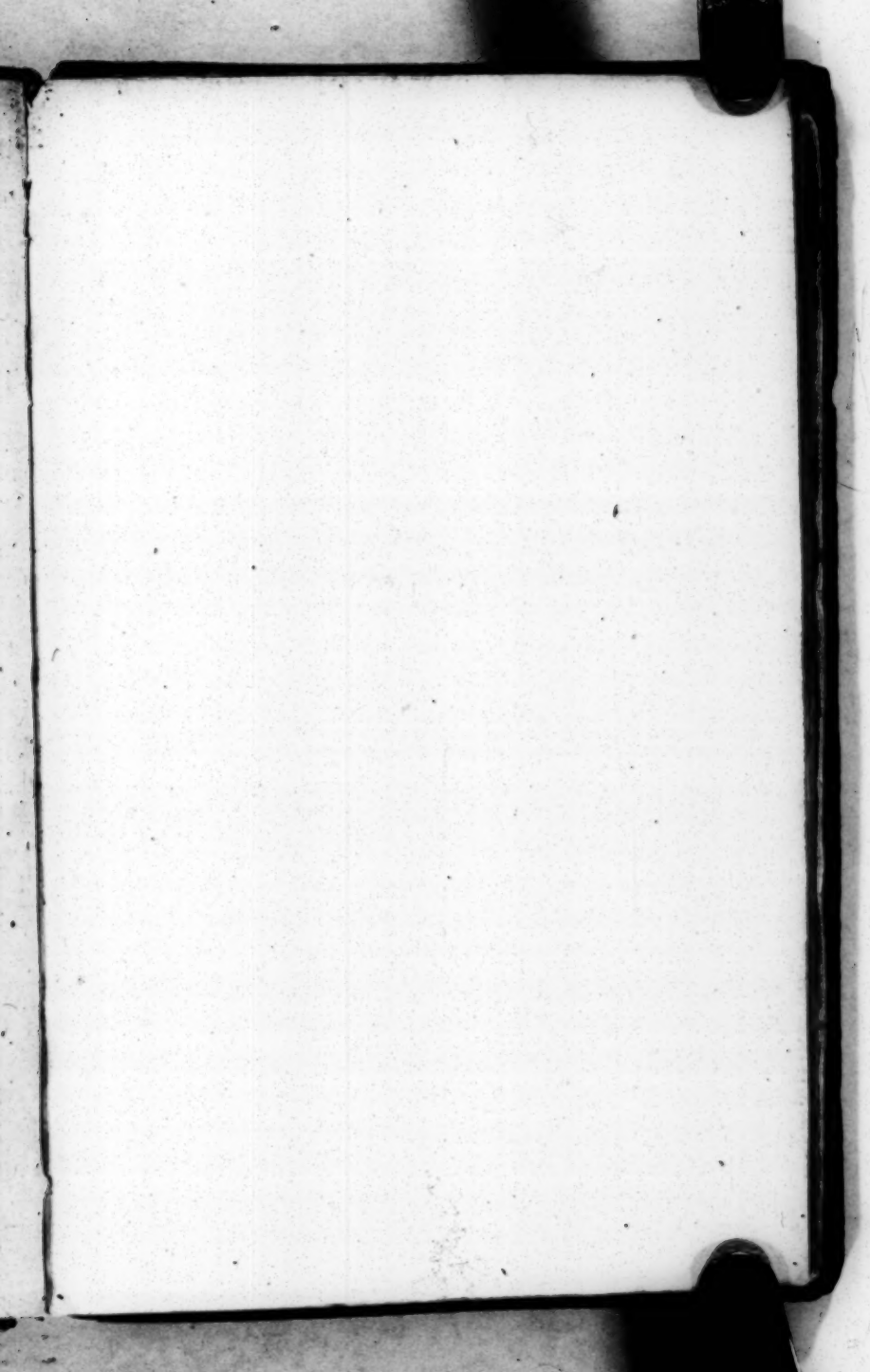
Rectifie the Bead, then bring it to the time given, and the thred will cut so many Degrees in the Limb, as the Sun will be high at that time: thus upon the 30 of *March* I find that at 8 a clock in the Morning the Sun is 24 Degrees and an half high, and it comes to the same height at four in the Afternoon the same day.

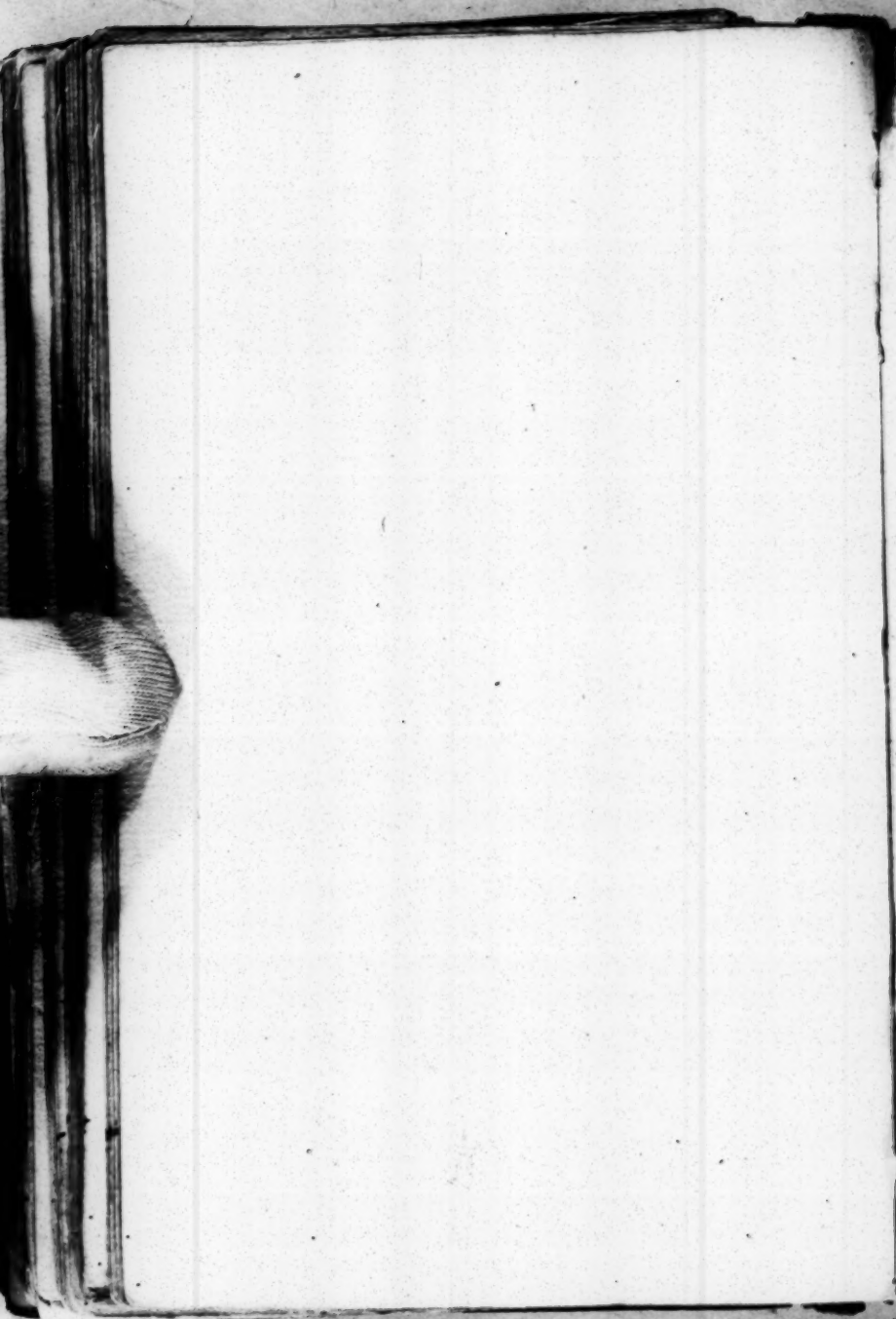
To find how low beneath the Horizon the Sun is at any Hour of the Night.

Rectifie the Bead for the preceding day, and bring it to the hour of the night, and in the Limb the thred will shew you how low the Sun is at any time of the Night: thus upon the 30 of *March* at 11 at Night the Sun is $28\frac{1}{2}$ degrees low beneath our Horizon,

To find the time of Day-break.

This is when the Sun is 18 Degrees beneath our Horizon; Therefore rectifie the Bead for the day, and lay the thred upon 18 Degrees in the Limb, and the Bead will fall upon the hour of Day-break; so upon the 30 of *March* the day will break at three of the clock in the Morning. And by this is easie to find when it will be dark at Night, for that must be so much after 6, as this is before 6, which is 3 hours; so at 9 at Night it will be dark, or past Twilight.





As on the left hand of the Quadrant, the Hour-lines are drawn bending from the Equinoctial to the Tropick; so likewise on the right hand of the Quadrant are drawn such other Lines, which bend also from the Equinoctial to the Tropick. And are called Azimuths; and are numbred in the Equinoctial with 10, 20, 30, &c. to 90. and then downwards from the Equinoctial to the Tropick with 110, 120, 130. and some odd degrees of Azimuth. Now on the Quadrant I mentioned before, you have not onely every tenth Azimuth-line described, but also every fifth Azimuth-line drawn with such touches of Lines, as the half hours are marked with.

Fifthly, *The use of the Azimuth-lines.*

Note: That those Lines that bend towards the Line of Declination, are the Summer Azimuths; and that which is nearest the Line of Declination, which is on the left hand, is the Meridian Line, or full South in Summer.

And all those drawn the other way, are the Winter Azimuths; and that next the Line of Declination (though bending from it towards the right hand) representeth the Meridian, or

full South point of the Compass in the Winter. But it is most painted with the Sun.

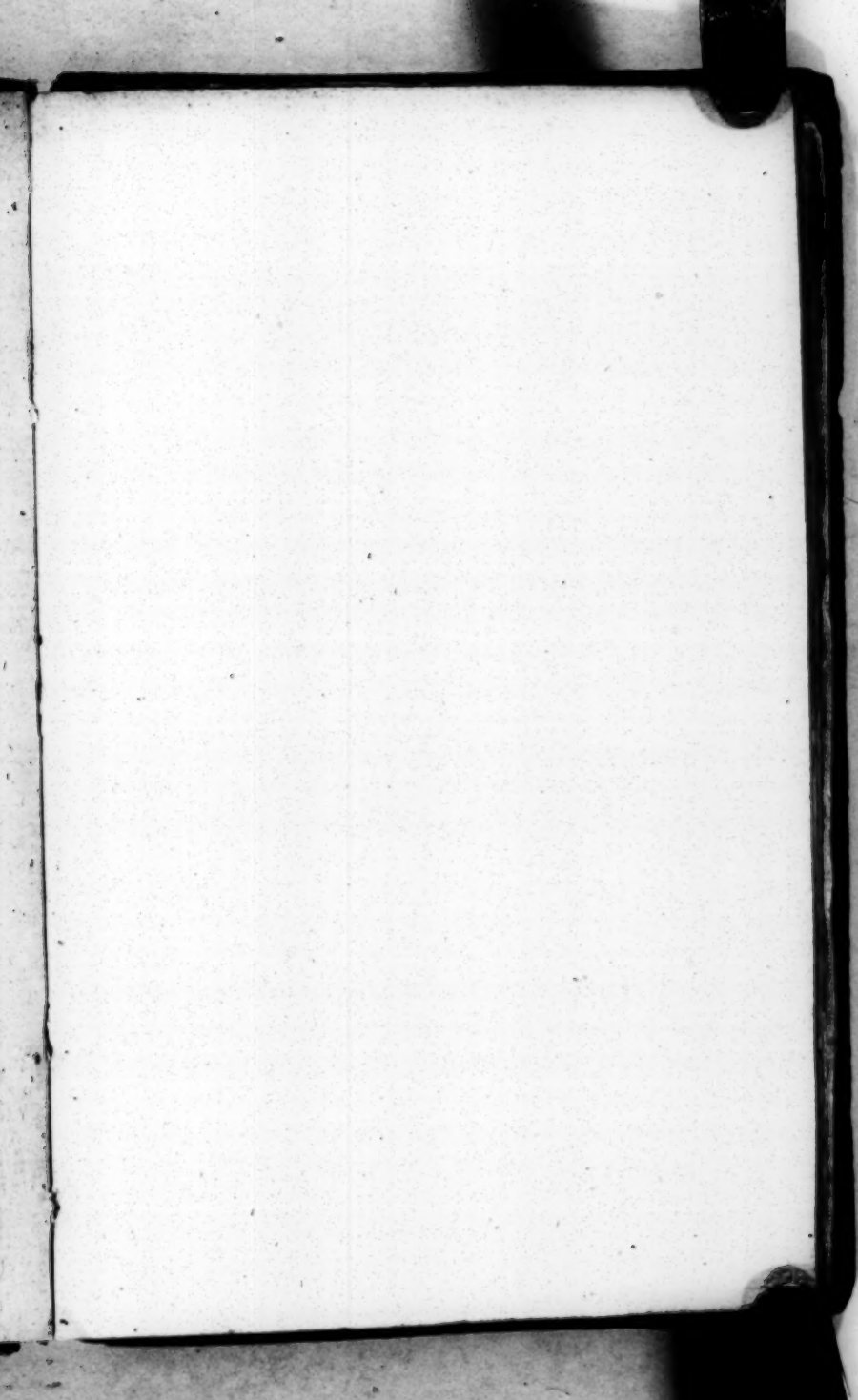
To find the point of the Compass wherein the Sun bears at any height, do thus :

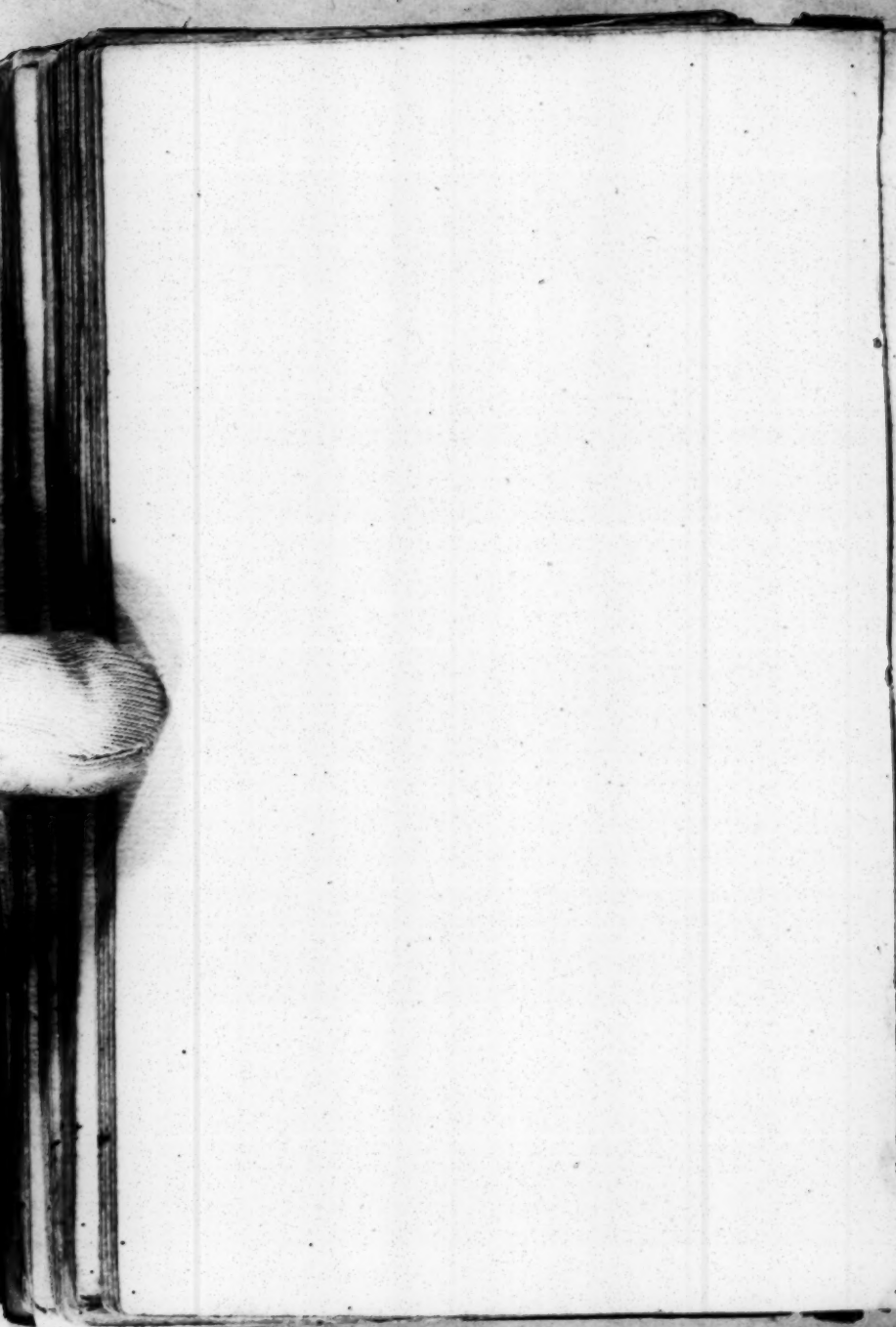
First, Rectifie your Bead : then take the Altitude of the Sun, and observe well that Altitude, and so much as your Altitude is, count so many degrees in the Limb from 90, and bring the thred to that degree; then will the Bead fall upon the true Azimuth.

EXAMPLE.

Upon the 9 of April I take the height of the Sun, and find it to be 25 Degrees; therefore I lay the thred 25 Degrees from 90 Degrees, and the Bead falls upon almost 80 Degrees from the Meridian; whether this 80 Degrees be from the Meridian to the Eastward, or to the Westward, I know by the time of the day; for if it be after Noon, then it is 80 Degrees to the Westward; but if before Noon, 80 Degrees to the Eastwards : this is of many great uses, and therefore I will shew how to draw a Compass upon any place whereon the Sun shines, be it either upon a Wall, or on the Ground.

First, with a pair of Compasses describe a good large Circle, the bigger the better; then when





when the Sun shines upon the Circle, set a small stick or nail upright in the middle or Center of the Circle; then take the height of the Sun, and note it well; then presently make a mark at the end of the shadow of the nail or stick; then take away the nail, and lay a Ruler over the Center, and the mark you made at the end of the shadow, and so draw a Line from one side of the Circle to the other, by the side of the Ruler, then (as is before shewed) you may find how much one end of that Line is from the true South: then having so many Degrees as the Sun was from the South, lay the Center of the Quadrant upon the Center of the Circle; and from the Center of the Quadrant extend the thred to the place of the Sun upon that Circle, and bring that Degree which you know the Sun is from the Meridian under the thred, and one end of the Limb will point at the true South, the other at the East, if it be before Noon; but to the West, if it be after Noon; then is the North opposite to the South, and so have you the true East and West, North and South of any place whatever, which is any thing near *London*; as within 100 miles the error will be but small, but if it be true East or West from *London*, the error will be scarce any thing.

And

And thus you may find several particulars; as in finding how one place lyeth from another: and also to describe a Dyal on a plain level place: and how much the Magnetick Needle varies in any place.

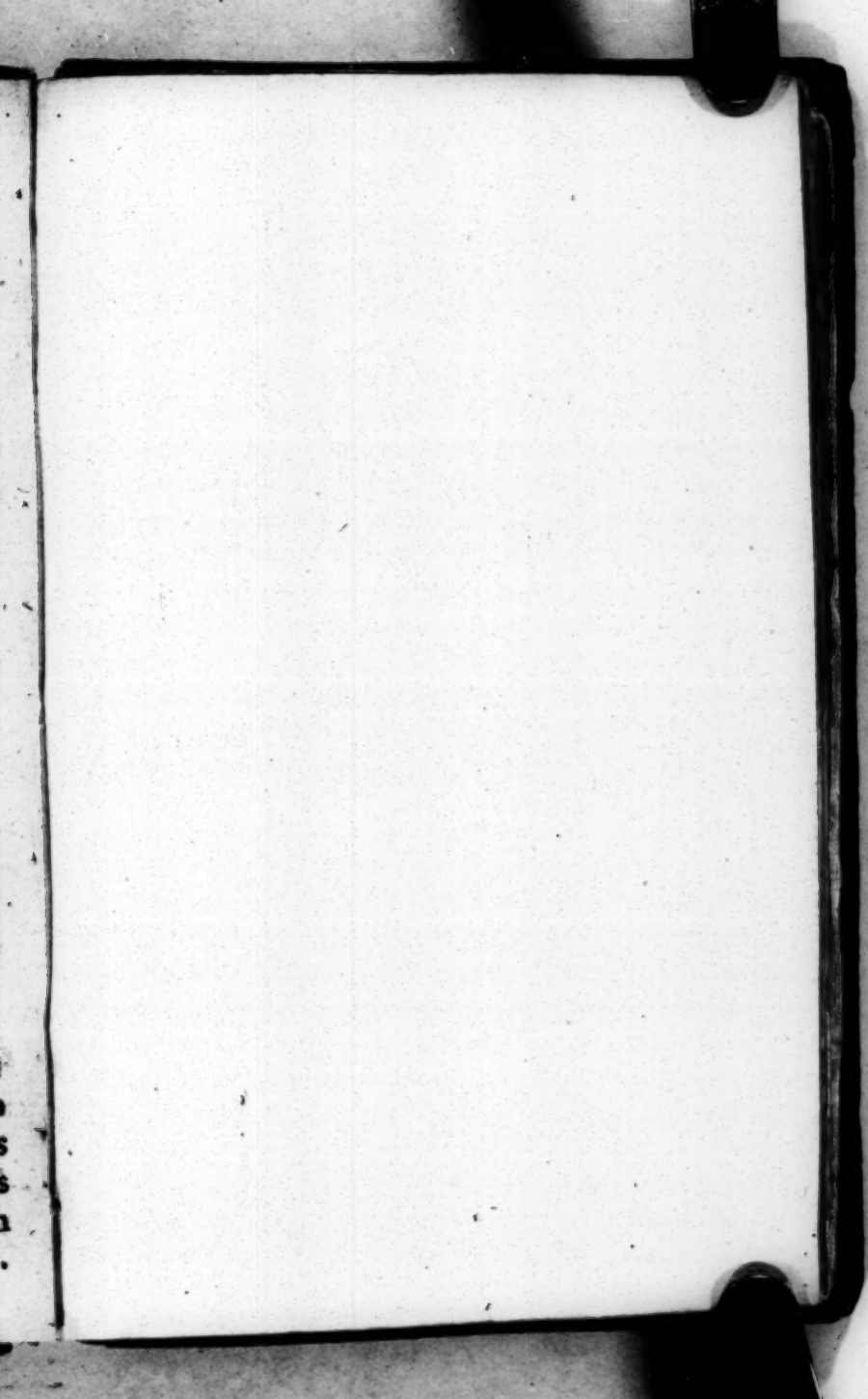
Now you may divide the Circle you make into 360 Degrees, and describe the 32 points of the Compass, and many very rare conclusions. And as I desire thee to take heed of all errors and mistakes, so especially in this, that you be sure to account your Altitude from 9 towards 10 degrees in the Limb; for this you must alwaies do in finding out the Suns Azimuth, or point of the Compass; and so by the contrary rise asie

To find the height of the Sun at any Azimuth; thus:

Rectifie the Bead, then bring it to the Azimuth whereon the Sun is: and so many Degrees in the Limb, as is between the third and 90 degrees, or the end of the Limb; so much is the Altitude at that time.

Lastly, The use of the five Stars is thus.

PUt the Bead to the Star you intend to observe, and find how many hours it is distant from the Meridian, or 12 at Night, as you found how far the Sun was distant from



12 at Noon; then find the Right Ascension of the Sun, and also the Right Ascension of that Star; then out of the one take the other, and turn the rest into Time; allowing 15 Degrees for an hour, and 4 Minutes for a Degree; then that time you found to remain after the subtraction, add to the hours you find the Star from the Meridian, and they will make the time that is since twelve a clock at Noon.

The Use of the

NOCTURNAL.

I. What the Nocturnal is.

T is an Instrument consisting of two parts:

1. A Circle, which is divided into 24 hours; and each hour into so many parts as the space between each hour will admit of.

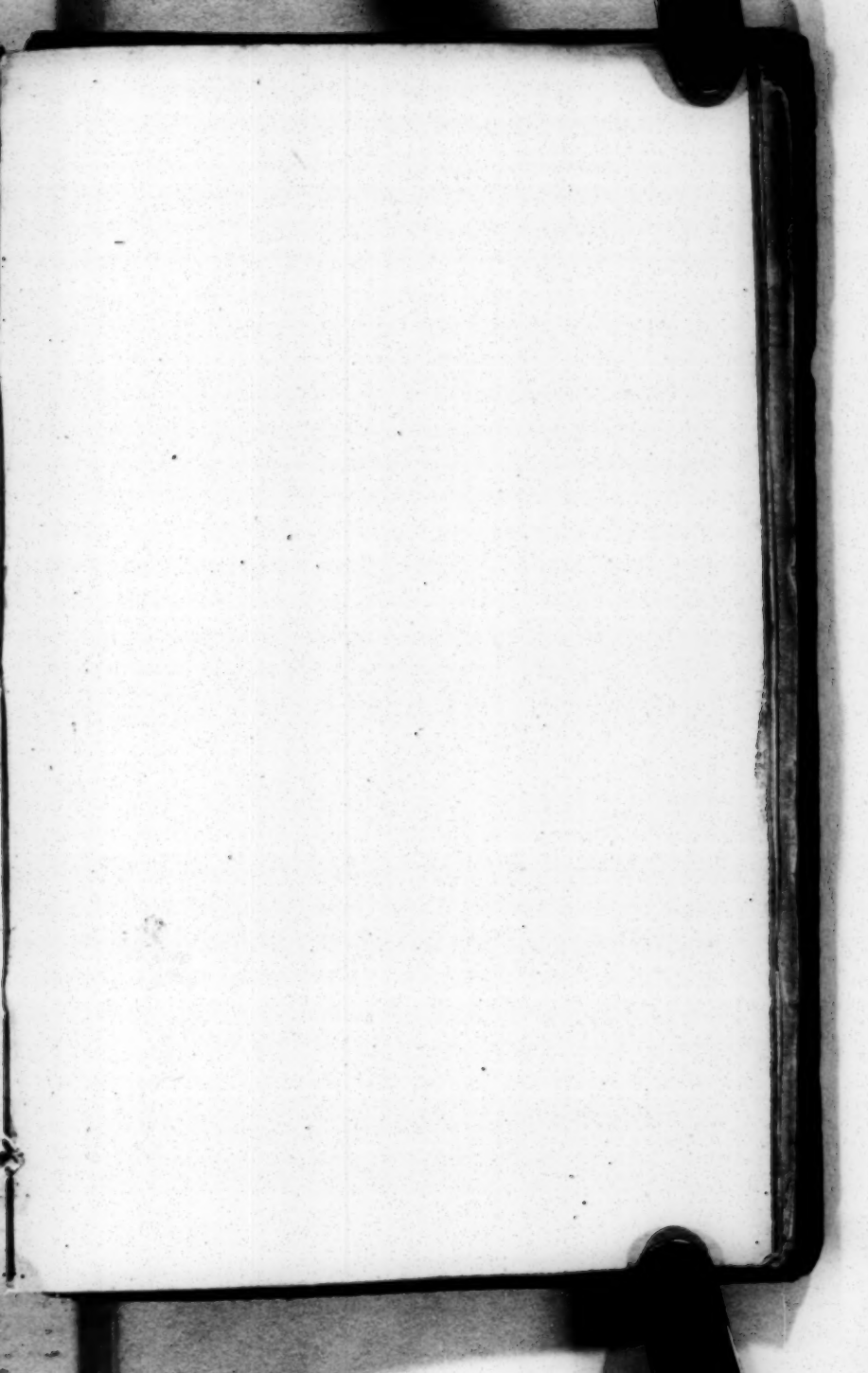
The Nocturnal fitted to the back-side of that Quadrant I have already treated of is divided into four quarters, and each quarter into two parts; so as the whole hour is divided into 8 equal parts; each equal part containing 7 Minutes and an half, as you may see in the Nocturnal

Quintant it self; upon the hour of 12 there is placed a *Flower de Luce*, to signifie the North point; and in the outmost Circle the names of all the other points of the Mariners Compass.

The second part of it is a *moveable Rundle*, the Circle whereof is fixed to the Center of the Circle of Hours, that so you may turn it round as occasion requires. The outmost Circle of this Rundle is divided into 12 parts, for the 12 Moneths, each Moneth having its name prefixed to it in Roman Capital Letters, and each day in the Moneth distinguished with a small stroak and every tenth stroak for the reader counting the daies drawn longer, and marked with figures thus 10, 20. &c. according to the number of stroaks from the beginning of the Moneth.

Within the Circle of Moneths is another Circle described, divided into 12 equal parts, representing the 12 Celestial Signes: every Sign having its name prefixed to it in Italian Capital Letters, and each Sign sub-divided into 30 degrees, and each tenth degree marked 10, 20, or 30 according to the number of degrees from the beginning of the Signe.

In the rest of the Plane within this Circle is described those fixed Stars that are near the North-Pole, and belonging to seven Constellations ;



lations; whereof that which is in the middle, is called **URSA MINOR**, (of some **HELIX MINOR**) which in English is the *little Bear*, it being in the form a Bear.

This Constellation consists of seven Stars, whereof three onely are splendent; that is the *Pole-star* in the end of the *Tayl*, and those two that are in the fore parts of the *Bear*, one of them upon his Back neer the Neck, and the other upon his side; and these two are called of our Mariners *the Guards*. These three Stars are of excellent use in Navigation, and well known by Sea-men.

The next Constellation is **DRACO**, or the *Dragon*, and hath sundry Stars, which you may learn to know by the Rules following. The third is **CEPHEUS**. The fourth is **CASSIOPEIA**. The fifth is **URSA MAJOR**, or the *great Bear*. The sixth **AURIGA**. The seventh **CYGNUS**.

And lastly, there is twelve Lines drawn from the Pole, which are Meridians, and are of great use as you shall learn hereafter.

Here followeth severall Uses of the Circles of the Nocturnal.

1. The Circle whereon the Rundle is fixed, which is divided into 24 hours, notes the 24 hours of the Night and Day, and also the

the quarters of every hour, and half of each quarter, which is but seven Minutes and an half; so that you may work to half a quarter of an Hour of Time by this Instrument; be it either Time given, or Time sought for, as the question importeth.

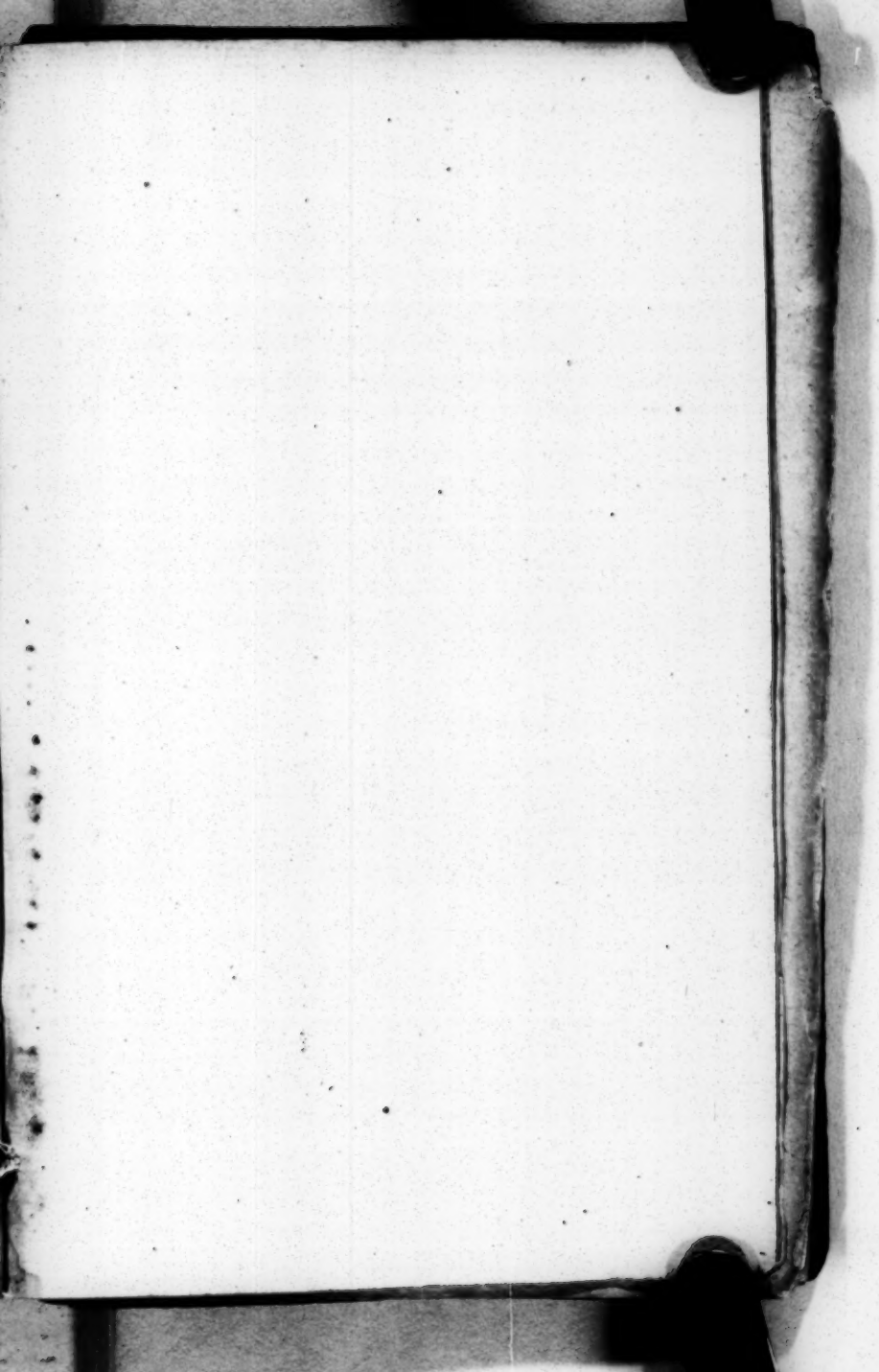
2. The use of the Moneths, and their divisions into daies, is either to give the day of the Moneth sought for, or by the day of the Moneth given, to find another thing required, as the question imports.

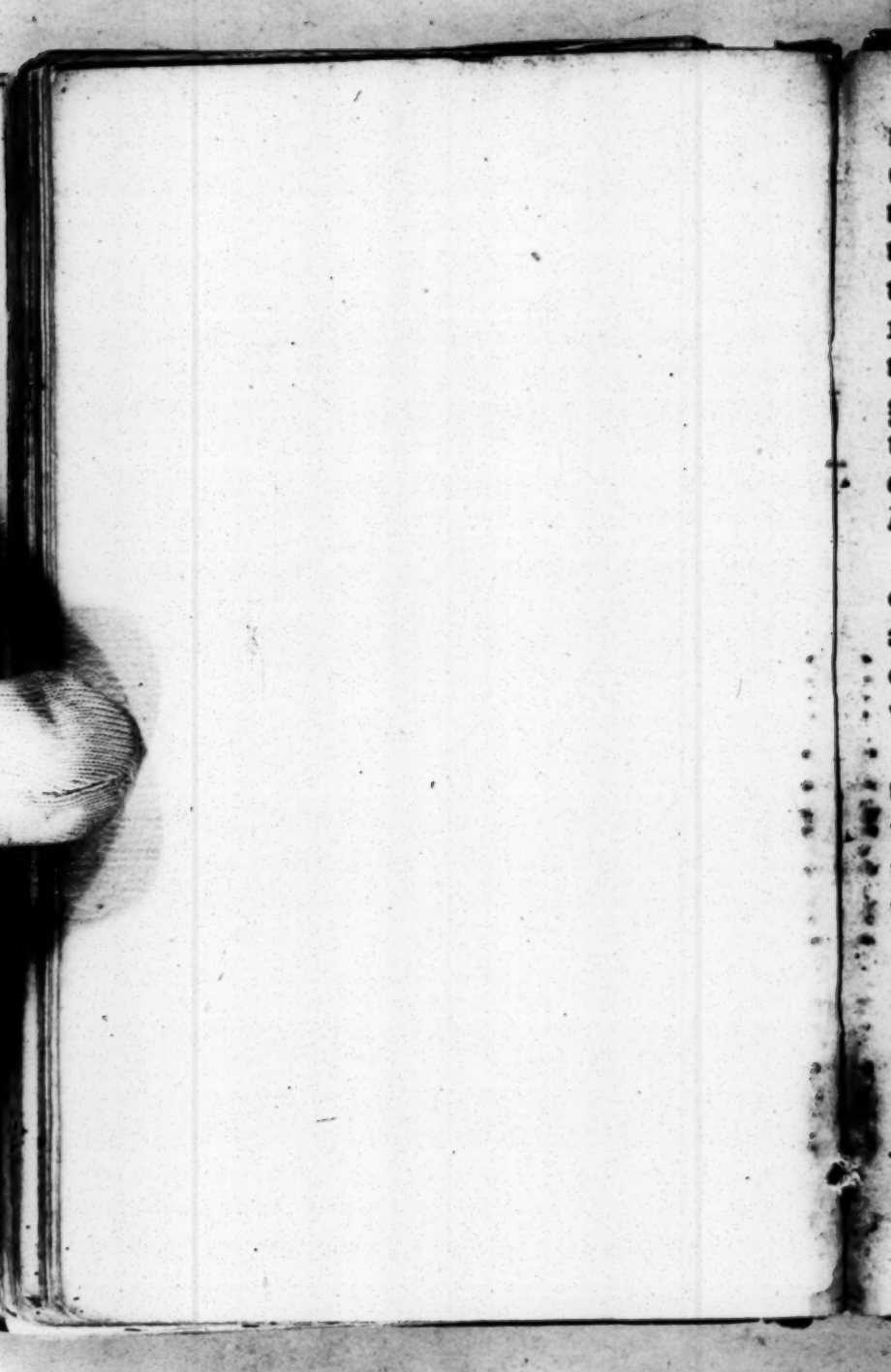
3. The use of the Circle of Signes is to know the Place of the Sun in the Ecliptick every day in the year.

4. The use of the Stars and their Constellations is two-fold: 1. To learn to know those Stars one from another, and from all other Stars. And 2. Knowing them, to make use of them, as the question ye are to resolve requires,

And note this, That that Star which is in the *Tayl* of the *little Bear*, is nearest the North Pole, and as in the Rundle all the rest of the Stars seem to move round this Star, so do they in the Heavens seem to move round it also: This being an exact Type or Figure of the Stars near the Pole.

5. The use of the Meridian lines which meet





meet in the Pole is threefold : 1. For the more ocular distinction of each Signe. 2. To shew the Right Ascension of any Star described in the Rundle. 3. For the finding the Declination of any Star on the Rundle, one of the Meridian lines; *viz.* that which passes through the beginning of *A R I E S*, is divided into degrees of Declination. And 4. To shew how to bring any Star to the Meridian of the Nocturnal, which is the hour of 12 under the *Flower de Luce*.

And because we seldom see a Star just upon the Meridian, therefore do these Meridians also shew how to place the Star either short or past the Meridian, which we could not do well by guess.

Thus much I judged meet, not only for the use that these definitions are of in the use of this Instrument, but because they may satisfy the desire of some that are not versed in Mathematical Phrases, and yet would willingly know the reason of such things. I shall now shew a few of the most practical uses of this Instrument, that may be easily understood of those that are not Mathematically disciplined.

First then, *To learn to know the Stars described in the Rundle one from another, and from the rest of the Stars that we see in the Heaven.*

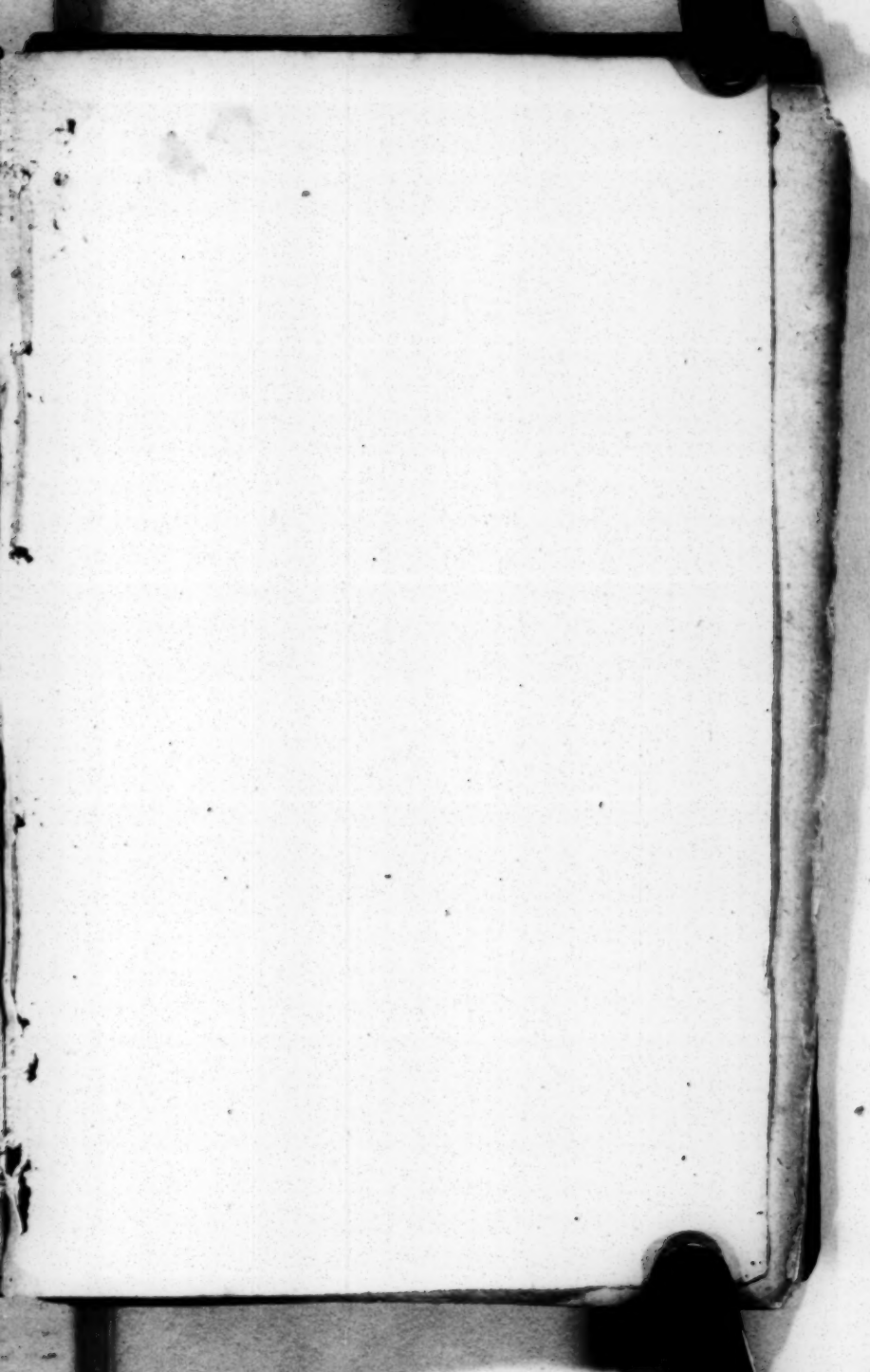
In

In a Night when the Stars may be seen, look toward the North part of the Heaven, and there you may take notice of seven very bright Stars, lying in the same form as ye see in the Image of the *great Bear*; four lying in a square, or like the four Wheels of a Waggon, and three, which you may imagine to be three Horses following one another; the form how they lie, you may see in the Rundle between the Signes *Virgo* and *Libra*: these being well known, you may look what Star lies near any one of them, and there you will find what Star it is. As for Example,

I see a Star lying just over the Star in the *great Bears* back: looking in the Rundle I find that Star to be in the end of the *Dragon's* ray, and so you may learn to know them all one from the other, comparing the Stars ye see in the Heaven, to them that are in the Rundle; and though you may see many Stars in the Heaven, yet these are the brightest, and of greatest Magnitude amongst them.

Another way to know the name of a Star, and to know it from others.

First note a Star in the Heaven, that you see is upon, or near the Meridian; then look in the Nocturnal for the day of the Month, and bring that day to the Hour, of the Night next the *Flower de luce*, then look what Star lyeth
between



between the *Flower de Luce* and the Pole in the Rundle; and if the Star in Heaven be lower then the Pole, the Star you find in the Nocturnal shall be the Star you saw in Heaven; But if the Star you saw in Heaven be above the Pole then must you seek the Star between the Center and the South point of the Nocturnal. But then if looking on the Rundle you find two Stars on the Meridian, note which is nearest the Pole, and which furthest off, and so you may know each from other.

EXAMPLE.

Upon the first of *April*, at half an hour past nine, at Night I see two bright Stars upon the Meridian, the one nearer me then the other; then to know the names of those two Stars, and to know them from others, I bring the first of *April* to half an hour past nine near the *Flower de Luce*; (which *Flower de Luce* notes Mid-night;) and because the Stars in Heaven are higher then the Pole, I look from the South point of the Nocturnals Limb towards the Center of the Nocturnal, and then see the Star nearest me (as it lies in Heaven) to be in the *Belly* of the *great Bear*; and that furthest from me, to be in the back of the *Bear*; and

D

then

then looking a little to the Eastwards in Heaven, I see two more follow, and after them cometh three more: for these I look in the Rundle, and one of the two next to the two I found on the Meridian, is upon the *great Bears Thigh*; the other on his *Buttock*: The first of the three following, is in the root of the *Tayl*, the second about the middle of the *Tayl*, the third in the end of the *Tayl*: And by this you may come to know all the Stars inscribed in this Rundle.

How to find out the North Star, from the rest which you see in Heaven.

This star is very bright, being one of the second Magnitude or bigness.

The most exact and speedy way is this :

Take your Quadrant, and, as near as you can guess, look through the Sights of your Instrument into the North part of the Heaven so high as is the Latitude of your Place, and it will soon shew you where-about it is, for there is no Star so great near it; and when you have thus found it, be sure you note it well how it lies from other Stars, that you may know it again: Thus at *London* the Latitude being 51 Degrees and an half, I lift up the Sights of the Quadrant till the third fall upon 51 Degrees and an half; then looking still at star
height,



height, I look as near the North point as I can guess, and there, or very near, is the Pole or North-star. If you have a Magnetique Needle; that will shew you the North point of Heaven.

The next way to find the North-star is this, which is done without any Instrument.

Look into the North part of Heaven; Note some Star that is little above half the height of Heaven, from the lower part of the Heaven; and by diligent notice, see whether in an hours time or more, you can see it remove from the place where you first saw it; if it be removed, that is not the Star; and so continuing, note the Star that lyeth as before-said, half above the Horizon, and moves not, and that is the Pole-Star; and this Star will be the sooner known, because it is more remote from any bright Star then any Star near it.

The reason why this Star scarce moves, is because it is near the Pole, and the other Stars moves round this; yet is not this Star without a motion, for it moves round the true Pole, but the ey can scarce perceive it to move at all.

An example of this in a Night when the Stars may be seen:

I look up half way into the Heaven, and a little higher, and as near North as I can; which I know by the building of a Church, whose

Steeple stands alwaies West from the Church, and there I see a bright Star by it self, and it stands so that I may just see it by the edge of a House-wall; then I mark how and where I stood, and go away, and come two, three, four, or five hours after, and stand just in the place as I did before, and find that the Star is not removed out of that place; therefore by all tokens this must needs be the Pole-star: but if I find the star removed, I conclude that that is not the star, but I try another, and another, till I do find it; taking this for a sure ground, that it lyeth full North from me, and that a little above half of the height of the Heaven, or thereabout, in the Latitude of 51 degr.

The next thing is, How to know the Meridian in the Heavens.

Having found out the North-star, fix your ey upon it, and imagine as near as you can a direct Line to be drawn from that Star to the place in the Heaven right over your head, and that Line is the Meridian; and when you see any known Star come to this Line, then is that Star upon the Meridian; when a Star is not quite come to it, that Star is said to want of its coming to the Meridian; when a Star is gone past this Line, 'tis past the Meridian; and this Line (for so I call it, because all men know
not

not the meaning of an Arch) is an Arch of the true Meridian of the place; and whereas I say let this Line be drawn from the Pole-star, it is for the ease of those who are not versed in Astronomy; though the true Arch of the Meridian must be drawn from the true Pole, yet in the use of this Instrument it begets no sensible error to draw this Line or arch from the Pole-star.

To find the Right Ascension of any Star in the Rundle.

Count according to the succession of Signes the number of degrees comprehended between the beginning of *ARIES* and a line drawn through the Center and your Star to the Circle of Signes for that is the number of degrees of Right Ascension your Star hath.

Example. I desire to know the Right Ascension of the bright star in the end of the *great Bears Tayl*. I lay a thred from the Pole through that Star, and draw it to the Circle of Signes; then begining to number at *ARIES* and proceeding to *TAURUS*, *GEMINI*, &c. I say 30, 30, 30, is 90. 30, 30, 30, is 90. more, that is 180, which is the begining of *LIBRA*, and almost 24 more, which is contained between the begining of *LIBRA* and the thred, that is almost 204 degrees for the Right

Ascension of the Star in the end of the *great Bears Tail*.

To find the Declination of any Star on the Nocturnal.

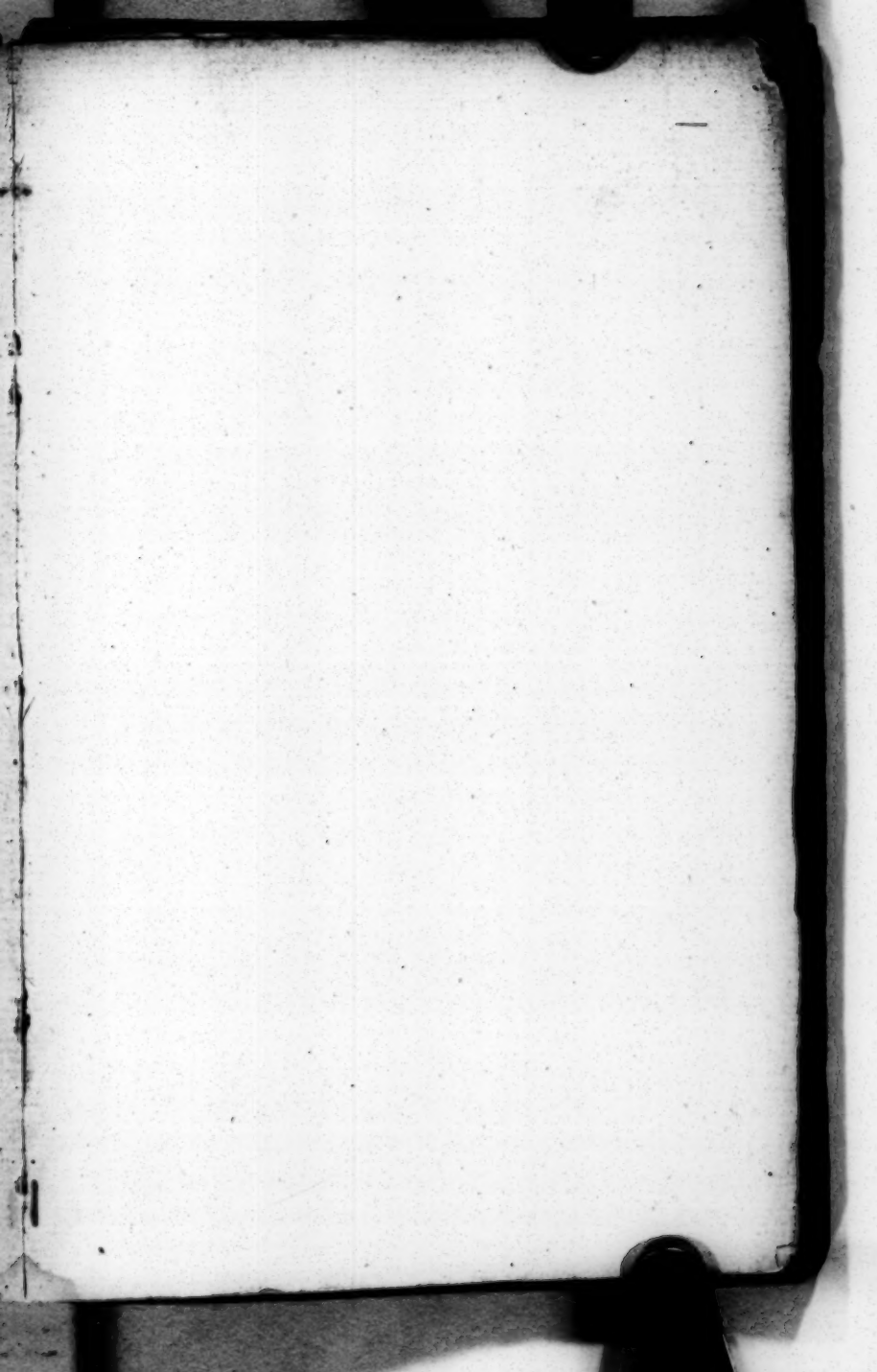
Pitch one foot of a pair of Compasses in the Center of the Nocturnal and extend the other foot to the Star; then keeping the first foot in the Center, turn the other foot to the divided Meridian line; and so many degrees as is contained between the two feet of the Compasses is the Complement of the Stars Declination: that is so many degrees the Star wants of 90. Thus the Declination of the aforesaid Star in the end of the *great Bears Tayl* is found to be 51 degrees and one quarter of a degree.

The day of the Moneth, and a Star on the Meridian being given, to find the Hour of the Night.

Bring the Star which you see upon the Meridian to the *Flower de Luce*, and then look for the day of the Month; and right against it you have the hour of the Night given.

Example. Upon the first of April at Night I see the bright Star in the rump of the *great Bears Tayl* upon the Meridian, therefore I bring it to the *Flower de Luce*, and looking upon the first day of April I find it is $\frac{1}{4}$ of an hour past 11.

Next,





Next, *The Hour of the Night, with a Star upon the Meridian given, to find the day of the Moneth.*

Bring the Star to the *Flower de Luce*, and right against the hour of the Night, is the day of the Moneth. This needs no Example.

The day of the Moneth, with the Hour given, to know what Star is upon the Meridian.

Bring the Time of the Day, and the Day of the Moneth together, and what Stars you find upon a right line imagined to pass between the North and South points of the Nocturnal, those are upon the Meridian.

The Day of the Moneth given, to find the Signe and Degree the Sun is in.

Seek the Day of the Moneth in the Rundle of the Nocturnal, and against it in the Circle of Signes you will find the Signe and Degree the Sun is in.

F I N I S.

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Prof. Harcourt Brown

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